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THE ABORIGINAL MOUND BUILDERS OF TENNESSEE.

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WHEN the first Anglo-American pioneers, about the middle of the last century, explored the country east and north of the Tennessee River, the territory between the Ohio and Tennessee Rivers was a vast unoccupied wilderness. The rich valleys, hills and plains of Tennessee and Kentucky were crowded with a dense growth of forest trees and canes, and formed an extensive park, held permanently only by the beasts of the forest, and abounding with immense herds of buffalo, flocks of wild turkeys, droves of deer and innumerable bears. The nearest permanent Indian settlements were on the Sciota and Miami on the north, and on the waters of the Little Tennessee on the south; and from these points the warriors of the Miami Confederacy of the north, and the Choctaws, Chickasaws and Cherokees of the south issued to engage in hunting and war, in this great central theatre. At this period, by common agreement of all the surrounding tribes, this section of country, which, for its fertile soil, numerous rivers and abundant supply of fish and game, was admirably adapted to the settlement of savage tribes, appeared to have been reserved from permanent occupancy.

That this country, in common with other portions of the

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great Valley of the Mississippi, was inhabited in ancient times by a comparatively dense population, who subsisted by the arts of husbandry, as well as by the chase, is evident from the numerous depositories of the dead in the caves and along the banks of the streams in the fertile valleys, and around the cool springs which abound in this limestone region, and from the imposing monumental remains and extensive earthworks.

A considerable portion of the city of Nashville has been built over an extensive Indian graveyard,* which lay along the valley of Lick Branch. A large portion of these graves have been removed in the building of North Nashville. In this section of the city I saw a number of these stone graves, exposed during the digging of the cellars of a row of houses, and obtained a small stone hatchet, and another implement of hard, silicious stone, beautifully polished. This stone implement is supposed to have been used in the dressing of hides. All around the sulphur spring, traces of the aborigines are manifest in the form of fragments of large pots and various implements. It is supposed that this salt lick was frequented by the Indians for game and the manufacture of salt.

Extensive fortifications, several miles in extent, enclosing two systems of mounds and numerous stone graves, lie along the Big Harpeth, about sixteen miles below Old Town, at

* An extensive burying ground lies on the opposite bank of the Cumberland, directly across from the mouth of Lick Branch, and another about one and a half miles lower down; another at Cockrill's Spring, two and a half miles from the Sulphur Spring; another six miles from Nashville on the Charlotte Pike, and still another at Hayesborough. Numerous stone graves are also found on White's Creek, on the Dickerson Pike, nine miles from Nashville, and at Sycamore, twenty-two miles from Nashville, on the plantation of Colonel Overton, and in and around Brentwood, at the Boiling Springs, and on the plantation of Mr. Scales. Extensive Indian burying grounds are also found in White County, near Sparta, and along the various streams flowing into the Cumberland and Tennessee Rivers, as Harpeth, Duck, Elk and Stone Rivers. At the plantation of General DeGraffenreid, two and a half miles above Franklin, numerous stone graves are found within an extensive earthwork, which appears to have surrounded a considerable Indian town. One large square mound, 230 feet in diameter, together with a chain of smaller ones, are found within the ancient fortification, with mounds and stone graves. One of the most remarkable stone-grave burying grounds is found on the west fork of Big Harpeth, six and a half miles from Franklin, at a place called Old Town, the property of Mr. Thomas Brown.

Mound Bottom and Osborn's Place. At these extensive fortifications, which enclose the sites of two ancient cities, are found three pyramidal mounds, about fifty feet in elevation, and each one containing an acre upon its summit, and besides these, numerous lesser mounds. Such structures must have required the labor of a considerable population for a series of years; and more especially must the erection of these earth pyramids have been slow and tedious, as the aborigines were without horses or carts, and the immense mass of earth must have been carried by hand in baskets and skins. The old road or trail which connected these two ancient cities can still be discerned in the forest, the well-worn way being in some places a foot or more beneath the general surface. It is evident from these facts that a chain of fortified towns extended in ancient days all along Big Harpeth, and from careful excavations and examinations and comparisons of the crania and relics, we are convinced that they were all erected by the same race. One of the most remarkable aboriginal remains in Tennessee is found in the fork of Duck River, near Manchester, and is known as the *Stone Fort*. The walls of the fort have been formed of loose rocks and stones gathered from the bed of the river. The gateway of the fort, which opens toward the neck of land between the two branches of the river, is carefully protected by an inner line of works, so constructed that the enemy entering the fort would be received in a blind pouch or bag. Directly in front of the gateway of the fort, and about half a mile distant, stands a remarkable mound, the structure of which is similar to that of the walls of the fort, being composed of rocks, none of which exceed a foot and a half in diameter. This oblong mound is 600 feet in circumference and forty feet in height, and the labor of collecting and depositing the loose rocks by hand must have been considerable.

It would be impossible for us upon the present occasion to enter into a minute description of the mounds of Tennessee.

They are found upon the Cumberland, Little Tennessee, Big Tennessee, French Broad, Elk River, Harpeth, Duck and Stone Rivers. As a general rule these mounds are erected upon rich alluvial bottoms, and are either surrounded by extensive earthworks, or are located in the neighborhood of these fortifications, which mark the site of towns. The mounds vary in number and size, in a measure, with the extent and richness of the valleys and the size of the earthworks. The smallest are not more than a few feet in height, and about thirty feet in diameter, while the largest attain a height of seventy feet, and cover an acre or two of ground. Many of the smaller mounds were used for the burial of the dead, others for the purpose of religious sacrifice and for the burning of the dead, while the largest pyramidal mounds were most probably the sites of the temples and council-houses of the aborigines.

The ancient inhabitants of Tennessee also left singular paintings upon the rocks, representing the sun and moon. These paintings occupy the face of perpendicular cliffs on the Harpeth, Tennessee, French Broad, Duck and Cumberland Rivers. The paintings are executed with red ochre, upon high, inaccessible walls of rock overhanging the water, and were, without doubt, devoted to sacred purposes, and were emblematic of the sun, the god of the aborigines. The paintings of the sun on the rocks on Big Harpeth River, about three miles below the road which crosses this stream from Nashville to Charlotte, can be seen for a distance of four miles, and it is probable that the worshippers of the sun assembled before this high place for the performance of their sacred rights. At Buffalo Gap, on the same stream, where the ancient trail of the buffalo is still distinct, a line of buffaloes is painted upon the cliff rock which overhangs from above, and is capable of sheltering a thousand men.

We have still another evidence of the existence of a numerous population, in the fact that the first settlers found the caves filled with human skeletons.

Haywood relates that in the spring of the year 1811, two human beings were found in a copperas cave, in Warren County, in West Tennessee, about fifteen miles south-west from Sparta, and twenty miles from McMinnville. One of these persons was a male, the other a female. They were interred in baskets made of cane, curiously wrought, and evidencing great mechanical skill. They were both dislocated at the hip joint, and were placed erect in the baskets, with a covering of cane made to fit the baskets in which they were placed. The flesh of these persons was entire and undecayed, of a brown color, produced by time, the flesh having adhered to the bones and sinews. Around the female, next her body, was placed a well dressed doeskin; next to this was placed a rug, very curiously wrought of the bark of a tree and feathers. The bark seemed to have been formed of small strands well twisted. Around each of these strands feathers were rolled, and the whole woven into cloth of a fine texture, after the manner of our common coarse fabrics. This rug was about three feet wide, and between six and seven feet in length. The whole of the ligaments thus formed of bark were completely covered by the feathers, forming a body of about one-eighth of an inch in thickness, the feathers extending about one-quarter of an inch in length from the strand to which they were confined. Its appearance was highly diversified by green, blue, yellow and black, presenting different shades of color when reflected upon by the light in different positions. The next covering was an undressed deer-skin, around which was rolled in good order a plain shroud manufactured after the same order as the one ornamented with feathers. This article resembled very much in its texture the bags generally used for the purpose of holding coffee, exported from Havana to the United States. The female had in her hand a fan formed of the tail feathers of a turkey, curiously bound with buckskin strings and scarlet colored hair, so as to open and shut readily. The hair of these mummies was still remaining upon their heads, and

was of a yellow caste and very fine texture. De Soto, in his march in 1539 and 1540, saw great numbers of similar feathered mantles; the Mexicans at the time of the Spanish conquest were clad in similar garments.

The tribes of Indians inhabiting the immense territory called by the Spaniards, Florida, embracing a country of indefinite extent, bordering upon the Gulf of Mexico, and including a large portion of the Valley of the Mississippi, and the present States of Georgia, Florida, Alabama, Mississippi, and the middle and western portions of Tennessee, were more highly civilized, and farther advanced than those in more northern regions; they were worshippers of the sun, were governed by despotic princes, cultivated the soil, had made some advances in the arts, and their manners, customs and religion all pointed to Mexico as their native country.

The population was much greater at the time of the invasion of De Soto than it has been at any subsequent period. Large armies were frequently arrayed against him. In Potosa, Florida, he was furnished with seven hundred burden bearers. In Ocute, Georgia, he was supplied with two hundred of these Indian servants, and at Cafeque, in the same State, four thousand more transported the effects of his army. A numerous population was found in the province of Coofa, and large forces opposed him at Maubila, Chickasa, and Alabama. The invasion of De Soto resulted in the destruction of an immense Indian population in all the territory through which he passed; they were not only destroyed in the bloody battles by thousands, but they were worn out by heavy burdens, and hunted down with bloodhounds. The European diseases, which the natives inherited from the Spaniards, served also to thin out their population. Again, the constant bloody wars in which they were afterwards engaged among themselves, and which, to a great extent, grew out of the invasions, still farther reduced their numbers.

The towns were surrounded with walls of earth and palisades, and had towers of defense. Entrenchments and

ditches were also found in various parts of the country. The most remarkable of the latter was at Pascha, west of the Mississippi. Here a large ditch, "wide enough for two canoes to pass abreast, without the paddles touching," surrounded a walled town. It was cut nine miles long, communicated with the Mississippi, supplied the natives with fish, and afforded them the privileges of navigation.

The natives formed artificial mounds for purposes of burial, worship, habitation and defense. The houses of the chiefs, with but few exceptions, stood upon large and elevated artificial mounds. When the Indians of 1540 resolved to build a town, the site of which was usually selected upon low rich land, by the side of some stream, or in the neighborhood of a large never-failing spring, they first erected a mound from twenty to fifty feet high, round on the sides but flat on the top. The habitations of the chief and his family were erected upon the summit. At the foot of the eminence a square was marked out around which the principal men placed their houses, and around them the inferior classes erected their wigwams. Some of these mounds had stairways upon their sides, and were so steep as to be accessible only by the artificial way. They were thus rendered secure from the attacks of an Indian enemy. Mounds were also erected over the chiefs after their death, whilst others were formed by the slow accumulation of the dead through ages.

The aborigines, at the time of De Soto, worshipped the sun, and erected large temples, which were also receptacles of the bones of the dead. The natives worshipped the sun, and entertained great veneration for the moon and certain stars. When the Indian ambassadors crossed the Savannah to meet De Soto, they made three profound bows toward the East, intended for the sun; three toward the West for the moon, and three toward De Soto. Upon the eastern bank of the Mississippi all the Indians approached him without uttering a word, and went through precisely the same ceremony, making to De Soto, however, three bows much

less reverential than those made to the sun and moon. Similar customs prevailed on the west bank of this great river. In the morning every Indian presented himself at the entrance of his cabin, and extending his hands toward the sun, as his first ray beamed from the eastern horizon, addressed a rude but fervent hymn of adoration to his glory. At noon they performed a similar act in token of their gratitude; and to the setting sun they addressed their thanks for all the bounties they conceived he had bestowed upon them during the day; and they were particularly careful that his last ray should strike their heads.

A remarkable temple was situated in the town of Talmaco, upon the Savannah River, three miles distant from Cutifachique, near Silver Bluff. It was more than one hundred feet in length, and fifty feet in width. The walls were high in proportion, and the roof steep and covered with mats of split cane, interwoven so compactly that they resembled the rush carpeting of the Moors. The roof was covered with shells of various kinds, arranged in an ingenious manner. On the inside beautiful festoons of pearls, plumes and shells extended along the sides down to the floor. The temple was entered by three gates, guarded by gigantic wooden statues, some of which were armed with drawn bows and long pikes, and others with copper hatchets. On the sides of the walls were large benches, in which sat boxes containing the deceased chiefs and their families. Three rows of chests full of valuable pearls occupied the middle of the temple. The temple abounded with beautiful garments manufactured out of the skins of various animals, and in the most splendid mantles of feathers.

Upon the route through Alabama and the neighboring States, De Soto found the temples full of human bones. The large towns contained stone houses, filled with rich and comfortable clothing, such as mantles of hemp, and feathers of every color exquisitely arranged. The dress of the men consisted of a mantle of the size of a common blanket, made

of the various barks of trees, and a species of flax interwoven and dyed of various colors; also, well dressed and painted skins, and garments worn with beautiful feathers. The mantle was thrown over the shoulders with the arm exposed. Great men were sometimes, after the manner of the Mexicans, borne upon litters by their subjects, while their heads were shielded from the sun by shades made of feathers or gaudily painted hides.

The important conclusion which we draw from these investigations is: That the race which erected the mounds and fortifications of Tennessee was existing and active at the time of the discovery of North America, and possessed the country with a numerous population, even as late as the exploration of De Soto. This conclusion, which is at variance with the theories propounded by various ethnologists of Europe and America, who assign a considerable period to the extinction of the mound builders, will be still farther sustained by the remarkable discovery which we have made during the progress of these investigations, of the cross, emblems of the Christian religion, and especially of the Trinity, the Saviour and the Virgin Mary in the mounds of Tennessee. We believe that the preceding conclusion is based upon incontrovertible facts and evidence.

We will proceed to consider, in the next place, the mode of burial practiced by the aborigines of Tennessee, as shown by their sacred and sacrificial mounds and stone graves.

The ancient race of Tennessee buried their dead in rude stone coffins or sarcophagi, constructed of flat pieces of limestone or slaty sandstone, which abounds in Middle Tennessee. Extensive graveyards are found in Tennessee and Kentucky along the river courses, in the valleys and around the springs, in which the stone coffins lie close to each other. These graves, although justly regarded as rude fabrics, nevertheless exhibit considerable skill in their construction, and are standing memorials of the regard in which the ancient race held the memory of the dead.

The manner of burial appeared to have been thus: An excavation of the proper size, according to that of the body of the dead, was made in the ground, and the bottom carefully paved with flat stones. Long flat stones, or slabs of limestone and slaty sandstone, were placed along the sides, and at the head and foot of the grave. The body or skeleton was then placed within the rude coffin, and the top covered with a large flat rock, or with several flat rocks. When a number of coffins were constructed together, the side rocks of the first coffin frequently constituted the side of the second, and so on. Many of the graves are quite small, only capable of containing the body of a new-born infant. Many of the short square graves, not more than eighteen inches, or two feet in length, contain the bones of adults piled together, the head being surrounded by, or resting upon the arm and leg bones. This class of graves, containing the bones of adults packed in a small space, was probably constructed at the general burying festival, or contained the remains of the dead which had been transported from a great distance.

In a small mound, about forty-five feet in diameter, and about twelve feet in height, which I opened, about ten miles from Nashville, on the banks of a small stream and spring, and which contained perhaps one hundred skeletons, the stone graves, especially towards the centre of the mound, were placed one upon the other, forming in the highest part of the mound three or four ranges. The oldest and lowest graves were of the small square variety, while those near or upon the summit, were of the natural length and width of the skeleton within.

In this mound, as in other burial places, in the small square stone graves, the bones were frequently found broken, and while some graves contained only a portion of an entire skeleton, others contained fragments of two or more skeletons mingled together. The small mound now under consideration, which was one of the most perfect in its construc-

tion, the lids of the upper sarcophagi being so arranged as to form an even-rounded, shelving rock surface, was situated upon the western slope of a beautiful hill covered with the magnificent growth of the native forest. The remains of an old Indian fortification were still evident, surrounding an extensive encampment and several other mounds. In a large and carefully constructed stone tomb, the lid of which was formed of a flat rock, over seven feet in length, and three feet wide, I exhumed the bones of what was supposed to have been an ancient Indian chief who had passed his hundred summers. The skeleton was about seven feet in length, and the huge jaws had lost every vestige of teeth, the alveolar processes being entirely absorbed.

The hill upon which the residence of Col. Overton stands, about nine miles from Nashville, was in ancient times covered with a flourishing Indian village. The circular depressions of their wigwams are still visible. The aborigines appeared to have been attracted to this locality by the noble spring which bursts out at the foot of the hill. Thousands of bones were exhumed in excavating the cellar of the family mansion. The crest and south-eastern slope of the hill are covered with stone graves, many of which have been opened by curiosity hunters. A large number are concealed by the rank growth of weeds and grass. Those which I examined at this locality were all constructed upon the same plan. Here, as elsewhere, the graves were of various sizes, from that just sufficient to enclose the remains of a little child, up to the long stone coffin of eight feet. Some have supposed that these little graves enclosed a race of pigmies, but upon careful examination of many, at various localities, we discovered that they were simply the graves of the young; for we found the teeth in all stages of development, from the toothless child, through the period of dentition, up to the appearance of the wisdom teeth. Some of the small graves contained the bones of small animals, apparently of dogs, rabbits, squirrels and wild cats, and of birds, such as the wild

turkey. These animals were buried with the children. Some of the burial mounds were evidently used also for sacred and religious purposes, and were held in high veneration as the resting place of royal families. Thus, in a small mound which I explored, about one hundred feet in diameter and about ten feet high, on the eastern bank of the Cumberland River, opposite the city of Nashville, and just across from the mouth of Lick Branch, at the foot of a large mound, which had been apparently used as a residence, I discovered the following interesting remains :

In the centre of the mound, about three feet from its surface, I uncovered a large sacrificial vase, or altar, forty-three inches in diameter, composed of a mixture of clay and river shells. The rim of the vase was three inches in height. The entire vessel had been moulded in a large wicker basket, formed of split canes, and the leaves of the cane, the impressions of which were plainly visible upon the outer surface. The circle of the vase appeared to be almost mathematically correct. The surface of the altar was covered with a layer of ashes, about one inch in thickness, and these ashes had the appearance and composition of having been derived from the burning of animal matter. The antlers and jaw bone of a deer were found resting upon the surface of the altar. The edges of the vase, which had been broken off, apparently by accident during the performances of the religious ceremonies, were carefully laid over the layer of ashes, and the whole covered with earth near three feet in thickness, and thus the ashes have been preserved to a remarkable extent from the action of the rains.

Stone sarcophagi were ranged around the central altar with the heads of the dead to the centre, and the feet to the circumference, resembling the radii of a circle. The inner circle of graves was constructed with great care, and all the Indians buried around the altar were ornamented with beads of various kinds, some of which had been cut out of large sea-shells, others out of bone, and others again, were com-

posed of an entire sea-shell, punctured, so as to admit of the passage of the thread upon which they were strung.

In a most carefully constructed stone sarcophagus with the face looking to the setting sun, a beautiful shell ornament was found resting upon the breast bone. It had a central sun, and the large circle around this curiously divided into three figures or equal parts, with two outer rows of suns (nine suns in the outer row, making twenty-three suns in these two rows), making with the central sun, twenty-four suns in all; and with stars encircling the suns. This ornament upon its concave figured surface, had been covered with red paint; upon the back the convex plane surface was smooth and plain, with the exception of three crescentic marks.

The material of which it is composed was derived from a large flat sea-shell; no fresh water muscle, in any part of the waters of Tennessee and of the surrounding States, could furnish a uniform thickness of flat shell equal to this; and the regularity of its convexity and concavity, as well as the perfection of all its parts, and the uniformity of its thickness everywhere, are proofs that it must have been derived from a very large shell from the sea coast. This skeleton had around the neck, arms, waist and ankles, numerous beads of various kinds. The smaller beads were all of the small sea-shells. This stone grave had been constructed with such care, that little or no earth had fallen in and the skeleton rested as it were in a perfect vault. The head, which was evidently that of a woman, was in a remarkable state of preservation.

From the nature of the ornament upon the breast, as well as from the care with which the sarcophagus had been constructed, we judged that this was the priestess of the sun. In the grave of a child, near the right side of the grave of the priestess of the sun, and at the foot of the grave of a gigantic old Indian, seven feet in length, and of great age, as manifested by the loss of teeth, and the absorption of the alveoli, a curious small black idol was exhumed. The fea-

tures of this image resemble those of the Aztec, or ancient Mexican sculptures. The figure is kneeling, with the hands clasped across the breasts (forming a cross) in the attitude of prayer. This image is formed of a mixture of black clay and powdered shells, and is exceedingly hard, with a smooth, polished surface. The under jaw of the old Indian, whose grave lay near this idol, was of remarkable size, and had only one long, sharp fang, like the tooth of a wild animal. On the left of the grave of the priestess of the sun lay two other most carefully constructed graves, in one of which numerous beads were found, enclosing or encircling various portions of the skeleton, and in the other a large sea conch. Also two copper ornaments, lying on the side of the head of the skeleton, or rather two round pieces of wood, with a hole in the centre, and covered with a thin layer of copper. Two skeletons, apparently those of a man and woman, were found on the southern slope of the mound near the altar, which had been interred without any stone coffin. In the hand of the woman was a beautiful, light reddish yellow vase, painted with regular black figures. Under the head of the male skeleton lay a splendid stone hatchet with the entire handle and ring, at the end of the handle, cut out of a compact green chloritic primitive stone. A circle of graves extended around the inner circle, which we have described as radiating from the altar. The stone coffins of the outer circle lay at right angles to the inner circle, and rested as it were at the feet of the more highly honored and favored dead. In the outer graves no ornaments were found—only a few small arrow heads and fragments of shells and pots. After careful examination, we were forced to the conclusion that this sacred mound was formed at the time of the death of some celebrated chief or chieftess, the representative of the sun; and the more distinguished members of the family were buried in the inner circle around the altar, where the eternal fire was kept, and the more humble relatives and attendants around at their feet. It is probable that this sacred

mound marked the site of an ancient temple of the sun, in which the aborigines kept the eternal fire. The sacrifices upon the altar appear, from the bones of the deer, the antlers, etc., to have been not human, but animal.

That the aborigines of Tennessee were idolaters, is manifest from the stone and clay idols, which have been found in various portions of the State, some of which were found in caves, and others upon the summit of high mounds.

It is worthy of notice that some of the idols have the forehead flattened, making an exact line with the nose, and resembling in all respects the Toltec heads of Mexico, while others are represented with full round foreheads; and it is still further worthy of notice that the hair of the head of the idols is represented in a very different mode from that in which the nomadic tribes of North American Indians now wear it. In the female idols the hair is gathered into a knot or "waterfall" behind, while in the male idols it is bound into a cue behind, like the hair of the Chinese. These remarkable sculptures in hard sandstone, limestone and porphyry, correspond in features and mode of hair dress with the inhabitants of Central America, at the time of the Spanish conquest.

Herera, in describing the inhabitants of Yucatan, says: "They flatten their heads and foreheads, their ears were bored, with rings in them, their hair was long like women, and in tresses, with which they made a garland about the head, and a little tail hung behind."

The most important and interesting result in the entire series of investigations is the discovery of undoubted symbols of the Catholic religion in the stone graves and mounds of Tennessee. In a stone grave in a small mound within an extensive fortification on the banks of Big Harpeth River, two and a half miles from Franklin, on the plantation of General DeGraffenried, four copper crosses were exhumed, resting upon the skull of an old Indian. The copper had stained the bones of the cranium of a deep green color. In

their general outlines two of these crosses presented the general contour of the human figure. The crosses appear to have been stamped upon the copper plates with a die.

This grave also contained a remarkable vase, fashioned of a light yellow clay and crushed river shells, upon the sides of which were painted in black, three crosses, surrounded with three circles and three crowns. The rounded body of the vase was accurately divided into three portions, by the black pigment disposed in three black bands, uniting at the base and neck of the vase, thus leaving three circular spaces, upon the rounded sides, which were ornamented with the central cross, an outer circle around each cross, while this circle was again surmounted by the crown. Each crown had ten prominences or points. The superior portion of the neck of the vase was arched and so turned as to form the mouth horizontally. The summit of the vase terminated in a well shaped nipple.

In a similar burial mound within the same enclosure, amongst other most interesting relics, we discovered two large vases, marked in a similar manner, with three divisions, three central crosses, three circles around the crosses, and three crowns. In these large vases the points of the crowns were drawn out so as to resemble spikes and thorns, and in one of the vases the ends of the thorns, or those portions which would form the circle of the crown are represented as if plaited together. Two vases of similar construction were also exhumed, one with the head of a Spaniard, with a helmet upon the crown. The resemblance of the features to those of a Spanish Cavalier is wonderful. This small vessel was used as a paint bowl, and still contains the red ochre. The other black vase is fastened on the summit after the manner of a hood. Another small idol fashioned of white clay, found in Middle Tennessee, painted with the same black pigment, and dressed in what appears to represent a woven garment, has the sign of the cross upon both shoulders. The idol found in the sacred mound, as we have before

said, has the arms crossed upon the breast, in the attitude of prayer, the crown upon the head has three prominences, and the hatchet has three marks upon its head, and the beautiful shell ornament from the same mound has the symbol of the Trinity, both upon the anterior and posterior surfaces.

A circular shell ornament, with a well formed crown in the centre, which had been filled with some kind of red pigment, was discovered by Colonel Putnam in a stone grave near Nashville.

These religious relics are of a great interest in their bearing upon the probable date of the mounds and temples and graves in which they are found, and in the proof which they afford, that the inhabitants of America, have, at various times, come in contact with the civilization and religions of Europe, even before the recognized era of the discovery and exploration of the American continent.

In several of the crania, the *os-Incae*, characteristic of the Peruvian skulls, was observed. That this ancient race were descended from the Toltees, and were probably a branch of the Natchez, is rendered probable, not only from the conformation of the crania, but also from the history of this once powerful, but now extinct nation of the Natchez.

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER, M. D.

(Continued from page 35.)

CAT BIRD (*Mimus Carolinensis*). I was surprised to find the Cat Bird common entirely across the Rocky Mountains to Cœur d'Alene Mission, almost on the border of the Columbia Plains. It has the usual cry and habits of the species. I thought I saw *Oreoscoptes montanus* along the Hell Gate River, but may have been mistaken.

ROCK WREN (*Salpinctes obsoletus*). I observed this bird

occasionally through the main Rocky Mountain chain, to near the crossing of the Bitterroot, but less common than among the cliffs and rocks of the barren plains along their eastern slope. Though neither Dr. Suckley nor myself found it in the western part of Washington Territory, I have no doubt that it frequents parts of the rocky cañons of the Columbia Plain, and Nuttall says that he saw it at the "lowest falls" (Cascades) of the Columbia (Manual, second edition, Vol. I, p. 492). A nest with nine eggs was found in a log cabin below Fort Benton.

WINTER WREN (*Troglodytes hyemalis*). Seen only near the summit of the Cœur d'Aléne Mountains, in September.

CREEPER (*Certhia Mexicana*). Rather common, especially in the dark spruce forests of the Cœur d'Aléne Range. Habits and note exactly as in the eastern bird (*C. Americana*).

LONG-BILLED NUTHATCH (*Sitta aculeata*) and RED-BELLIED NUTHATCH (*S. Canadensis*). Both common in the Rocky Mountains as in the Cascade Range, but rare in the dense forests.

PIGMY NUTHATCH (*S. pygmaea*). Flocks of this little bird were met with at intervals from the eastern base of the Rocky Mountains, in August, to the Spokane River and Fort Colville, frequenting the open woods of pine (*Pinus ponderosa*), and were more gregarious, lively and noisy, than the preceding, constantly chirping like young chickens, and like them seeking insects more among the leaves than in the bark. It has also at times a harsh call much like the others.

NORTHERN TITMOUSE (*Parus septentrionalis*?, var. *albescens*). I obtained a specimen of this bird on the bank of the Missouri within the mountains, and as it is found at Fort Bridger, have little doubt of its crossing into Washington Territory, though I did not again recognize it among the many *Pari* I saw afterwards. The cries and habits of all these black-capped species are so nearly similar, that it requires a very near approach to distinguish them.

WESTERN TITMOUSE (*P. occidentalis*). Common in the Rocky Mountains, associating with the Mountain Titmouse.

MOUNTAIN TITMOUSE (*P. montanus*). Rather less abundant than the last, but alike in habits; call-note rather harsher. Both of my specimens are larger than more western ones. Seen with the last named at Fort Dalles, Oregon.

RUFIOUS-BACKED TITMOUSE (*P. rufescens*). I met with this only in the dense forests of the higher Cœur d'Alene Mountains, along with *Turdus naevius*, *Trogl. hyemalis*, etc., the same group most common in the similar forests of the Coast Mountains in this Territory. It there seemed to have all the business of Titmice to itself, and in notes is easily distinguishable from any of the preceding, though similar in habits. I saw it nowhere else east of the Cascades.

HORNED LARK (*Eremophila cornuta*). Abundant in the more open prairie districts everywhere. I found many of its nests along the Upper Missouri.

EVENING GROSBEAK (*Hesperiphona vespertina*). During my residence west of the Cascade Mountains, in 1854, I often heard a call uttered by some bird flying above the tops of the highest trees, and audible for a mile in still weather. I heard the same among and near the Cœur d'Alene Range, and saw the birds, but too high to distinguish the species. They made the cry only when flying from one tree to another, and when feeding among the top branches of the highest trees were so quiet that I never could even see them. I always supposed them to be the Evening Grosbeak, which they resemble in size, and Townsend's observations of its habits and notes agree closely with these remarks. (Nuttall, Manual, 1840, Vol. I, p. 620).

The habits of the Black-headed Grosbeak are quite different, as it lives commonly among bushes, or near the ground in open woods, and has no such cry. The birds seen may possibly, however, have been Pine Grosbeaks, which belong to the same long-winged group of arboreal finches, and were collected in these mountains in winter by Mr. Hildreth.

PURPLE FINCH (*Carpodacus*). I saw none throughout the journey.

YELLOW BIRD (*Chrysomitris tristis*). I saw this bird at the eastern base of the Rocky Mountains, and as it occurs also along the lower Columbia it is probably to be found in summer through nearly the whole territory. Nuttall found its nest on Lewis' (Snake) River. (Vol. I, p. 595).

PINE FINCH (*C. pinus*). Common throughout the mountains.

RED CROSSBILL (*Curvirostra Americana* var. ? *Mexicana*). Common throughout, and very abundant in the spruce forests of the Cœur d'Alêne Mountains, where it is remarkably familiar, feeding and dusting much on the ground, especially about the few log cabins built there. Among large numbers closely observed, I saw very few of the white-winged species. The male sometimes uttered a few musical notes much in the style of the Yellow Bird (*C. tristis*), but louder. The specimen preserved is much larger than those I collected on the west coast in 1853, with the bill also larger, and the proportions are even greater yet than those of Strickland's *L. Mexicana*, from the City of Mexico. (Baird's Rep., p. 924). The habits and notes are so universally similar that the various sizes can scarcely indicate more than local varieties, such as occur in nearly all our widely spread species. The bill and feet were, however, black instead of brown.

WHITE-WINGED CROSSBILL (*C. leucoptera*). The specimen preserved was shot from a flock of the common kind, on the eastern slope of the Cœur d'Alêne Mountains, by Capt. Floyd Jones.

CHESTNUT-COLORED BUNTING (*Plectrophanes ornatus*). I found this species with fledged young in July, on the plains near Fort Benton, where it evidently breeds.

LARGE SAVANNAH SPARROW (*Paserculus Sandwichensis*). This specimen I shot on the Spokane Prairie, September 24th, and saw a few more there and on other parts of the interior plains of Washington Territory afterwards. From the earli-

ness of the season, I suspect that it breeds in these regions, migrating to the coast for the winter, where I found it from October to May, in 1854. In habits it resembles the other Savannah Sparrows.

LARK FINCH (*Chondestes grammaca*). Common near Fort Benton, and occurring in small numbers on the prairies in and west of the Rocky Mountains.

WHITE-CROWNED SPARROW (*Zonotrichia Gambelii*, or *Z. leucophrys*?). I found this species only in the Cœur d'Alêne Range, from which circumstance I suppose it to be the *Z. Gambelii*. The young specimen preserved had brown feet, while the adult has them yellow in summer, but brownish in winter.

OREGON SNOWBIRD (*Junco Oregonus*). I saw no Snowbirds until September 1st, after which migrating flocks were common. I could only distinguish this species among them, though I saw some of a paler hue about the head, probably from immaturity.

CHIPPING SPARROW (*Spizella socialis*). Common throughout the journey, and nests were found on the Upper Missouri.

BREWER'S SPARROW (*S. Brewerii*). I found flocks, apparently of this species, on the eastern slope of the mountains only, migrating South in August. Two which I shot I took for the young of *S. socialis*, and did not preserve them, but I now think they were of this species. They frequented the open pine woods, which the former rarely does, preferring prairies.

The distinction of this from *S. pallida* is like that of young birds of the genus generally, and the lists of specimens given by Baird show that all may have been young birds, judging from the period of the year they were collected in.

WESTERN SONG SPARROW (*Melospiza rufina*). This Song Sparrow was common in the Rocky Mountains, and appeared to me to resemble *M. rufina* of the Pacific Coast in every respect.

BLUE LINNET (*Cyanospiza amœna*). I saw this bird on

the eastern slope of the Rocky Mountains, but not among them, though it probably occurs there sparsely.

LINCOLN'S FINCH (*M. Lincolnii*). Rather common in flocks along the Bitterroot River, migrating in September.

ARCTIC GROUND-FINCH (*Pipilo arcticus*). I observed specimens which I supposed to be of this species, entirely across the Rocky Mountains, and preserved one from each side. In habits they resembled the eastern and west coast species, and I observed little difference in their notes at that season from those of *P. Oregonus*. I also preserved a nest and eggs of this (?) from along the Missouri River.

BOBOLINK (*Dolichonyx oryzivorus*). At several points in the valley of the Bitterroot River, I heard and saw at a distance what I took for the Bobolink, the flight and flying-call exactly resembling that bird's. At Cœur d'Alene Mission I again met with it, but could not get near enough to shoot it or determine the species, though they frequented a wheat-field for several mornings. I know no bird likely to be mistaken for it, and having been found at Fort Bridger, a few probably go north to latitude $47^{\circ} 30'$, as they go to latitude 54° east of the mountains, according to Richardson. The *Calamospiza*, which is common near Fort Benton, I saw no farther west, and its notes and habits are quite different.

COW BUNTING (*Molothrus pecoris*). I saw this bird only once near Fort Benton, but as it abounds along the Platte River and follows trains of wagons, cattle, etc., besides being found at Fort Bridger and Sacramento, Cal., I should be surprised if it did not occur in the present limits of Washington Territory, at least along Snake River, and possibly follow emigration as far as the Cascade Mountains. I see no reason why it should not also emigrate to the open regions north of the Columbia; and Townsend has it in his list of "Oregon" birds (1834).

RED-WINGED BLACKBIRD (*Agelaius phoeniceus*). Common at Cœur d'Alene Mission, Fort Colville, and Bitterroot Valley.

WESTERN LARK (*Sturnella neglecta*). Found on every prairie throughout the Rocky Mountains.

WESTERN GRACKLE (*Scolecophagus cyanocephalus*). Common in all marshy meadows of the Rocky Mountains, except at a very high elevation.

RAVEN (*Corvus carnivorus*). A constant attendant at camp, especially when about to be broken up.

EASTERN CROW (*C. Americanus*). At Sun River, east of the Rocky Mountains, I saw several of this species, and noticed no peculiarities as to flocking, note, etc.

WESTERN CROW (*C. caurinus*). The first crows I saw west of the dividing ridge were a distant flock, at sixty miles, and again at a camp about twenty miles above the junction of Hell Gate with the Bitterroot River, where a flock of about one hundred flew over at dusk, probably towards a roosting place. Their gregariousness at that season (August 25th), and unusual noise, struck me as peculiar; and on other occasions farther down the valley I saw some, but most of them probably live near the settlements of the St. Mary's Valley.

At Cœur d'Aléne Mission I again found *large flocks* of crows, and on comparing one with the plates and descriptions contained in the Natural History of Washington Territory, I found it to agree with *C. caurinus* in the form of the bill, but to be intermediate between it and *C. Americanus* in size, though nearest the former. I am inclined to think it was *caurinus*, but, like several other Rocky Mountain specimens collected by me, larger than those of the same species from the coast. Its habits were different from those of *C. Americanus*, and as it occurs at the Dalles, it could easily cross the intervening country. It cannot, however, be much of a "fish-crow" in these mountains.

CLARKE'S NUTCRACKER (*Picicorvus Columbianus*). I found this bird from the first pine forests east of the Rocky Mountains entirely across, but more rare in the spruce forests, as it is in those west of the Cascade Mountains, evi-

dently because it feeds chiefly on the seeds of the Yellow Pine (*P. ponderosa*), which is either wanting or scarce among the spruces. I noticed large flocks flying in very loose order, with a steady, pretty rapid motion like a Jay, not in the least "by jerks, in the manner of a Woodpecker," as described by Townsend (Nuttall, Manual, 1840, Vol. I, p. 252).

BLACK-BILLED MAGPIE (*Pica Hudsonica*). No Magpies appeared along the Missouri River in June, until we had entered the "Bad Lands," where it cuts through the first mountain range, and pine woods began to appear. Thence they continued common throughout the route westward, and on reaching Vancouver, October 30th, I found them for the first time about there.

STELLER'S JAY (*Cyanura Stellerii*). I saw no Jays myself until we crossed the Bitterroot River, when they became common in the spruce forests. Dr. Suckley, however, found this species at St. Mary's Valley, in October 1853.

CANADA JAY (*Perisoreus Canadensis*). This bird appeared near the crossing of the Bitterroot, and was also common in the spruce forests of the Cœur d'Aléne Mountains, these being its favorite summer residence as they are near the coast.

BAND-TAILED PIGEON (*Columba fasciata*). I saw but one bird, which I think belonged to this species, near Cœur d'Aléne Mission, at the base of the most western range of mountains. It seems to leave the Rocky Mountains almost entirely to the next species, though a few have been obtained farther south, along their eastern base, by Say and Peale. (Nuttall, Manual, Vol. I, p. 753.*)

PASSENGER PIGEON (*Ectopistes migratoria*). The Passenger Pigeon, like the Cat-bird, astonished me by its frequency in the Rocky Mountains, as, although I saw no very large flocks, I saw some almost every day until I passed the Spokan Falls, just north of the Columbia Plains, where Lieut.

*I saw a flock at the Cascades of the Columbia as late as October 29th.

A. V. Kautz shot two. It thus seems to pass round to the north of that plain, and occasionally to cross the Cascade Range, as mentioned by Dr. Suckley in 1853.

Along the Missouri I often saw small flocks, and noticed quite a number of their nests in small trees between Forts Pierre and Berthold. I found one sitting June 7th, and heard that many build farther south, near Sioux City.

In the mountains they fed, in August, chiefly on the Service-berry (*Amelanchier alnifolia*), which, along the Hell Gate, attains a size and flavor unequalled by any I have seen elsewhere.

DOVE (*Zenaidura Carolinensis*). I did not see this bird anywhere in the mountains, though I found it above Fort Union, on the Missouri.

DUSKY GROUSE (*Tetrao obscurus*). This Grouse was shot at the very beginning of pine woods on the east base of the Rocky Mountains, and I often killed them afterwards all the way to Fort Colville, but none in very good plumage up to October.

FRANKLIN'S GROUSE (*T. Franklinii*). The first specimen met with was shot through the head with a pistol ball, by Lieut. L. R. L. Livingston. It is much smaller than numbers 123 and 124, which were trapped by the Indians near Fort Colville, three weeks later. I did not see any alive myself, but was told that in winter they are common south to Spokane River, and very stupid, standing by the roadside to be shot, having doubtless descended from the mountains, where they were unmolested. They are also common in summer near the pass, 5100 feet above the sea, on the Cœur d'Alene Range.

I now believe that two young specimens, one killed in Klickitat Pass, Cascade Mountains, in August 1853, the other near Spokane River, in October 1853, and mentioned in my Report as *T. obscurus*, "running through the snow," were of this species. In their immature plumage I then supposed the red mark over the eye to be merely a character of the

young. The "Small Brown Pheasant" of Lewis & Clark (?) is probably the immature *Lagopus leucurus*, which inhabits much more Alpine districts than any we traversed.

SHARP-TAILED GROUSE (*T. Columbianus*). This Grouse occurs abundantly at most of the prairie regions passed through, on Sun River, Deer Lodge, Bitterroot (St. Mary's) and Spokane prairies, probably finding its way down around the valley of Clark's Fork, and reaches Fort Colville in small numbers. I saw none, however, in the higher prairies of the Rocky Mountains, over 4500 feet above the sea.

SAGE-FOWL (*Centrocercus urophasianus*). I saw nothing of the Sage-fowl, which Col. Vaughan, who had a specimen killed near Fort Benton, says is very rare there. None were seen by our party on the Columbia Plains, north of Snake River, where they were common in 1853.

RUFFED GROUSE (*Bonasa Sabinii* var. ? *umbelloides*). I shot several specimens of this Ruffed Grouse from the east base of Mullan's Pass to Fort Colville, most of which were young or moulting, but showed more or less brown in their plumage, thus connecting the above named variety (?) with the other two forms, which it entirely resembles in habits, etc. I saw a much grayer one near Fort Colville in 1853.

GRAY CRANE (*Grus Canadensis*). Only two observed in the Rocky Mountains, and none elsewhere, except a tame one near Fort Colville, which followed our horses for some distance apparently for the pleasure of a race, running with wings spread until it was passed, then flying ahead and circling round to meet us again. It refused a piece of bread thrown to it.

BLUE HERON (*Ardea herodias*). I did not see this, nor any other species of Heron, west of Fort Benton. Lewis and Clark, as well as Dr. Newberry, speak of seeing White Herons below Snake River.

MOUNTAIN PLOVER (*Aegialitis montanus*). Rare along the east base of the Rocky Mountains, usually about the Prairie-dog villages, and might be expected to cross the

mountains as it does farther south. I do not recollect, however, having seen any of the small waders anywhere in the mountains, though I noticed the Field Plover (*Actiturus Bartramius*) at the eastern base of Mullan's Pass, a bird never yet obtained west of the mountains.*

WILSON'S SNIPE (*Scolopax Wilsonii*) was seen at Cama, Prairie Creek, on the eastern border of the Columbia Plains, about the end of September.

ESQUIMAUX CURLEW (*Numenius borealis*) breeds near Fort Benton, where young were caught in July, still downy, but I have seen no Curlew on the Columbia Plains, though a species is said to abound near Fort Dalles, Oregon, in the spring.

SWAN (*Cygnus Americanus?*). Swans were seen in large flocks on the Columbia River, in the Cascade Cañon, as early as October 29th, this year (1860), and their migration southward seemed generally early. I saw them, however, on lakes of the Columbia Plain about the same time in 1853.

CANADA GOOSE (*Bernicla Canadensis*). Great numbers of this goose breed along the Missouri, where we saw broods every day from Fort Leavenworth up to Fort Benton. They are said to lay in nests, on trees, probably deserted nests of some other large bird. I saw two at Spokane River, Washington Territory, September 25th, which were probably summer residents there.

MALLARD (*Anas boschas*). Common in summer in the valleys of the Rocky Mountains, where it breeds.

GREEN-WINGED TEAL (*Nettion Carolinensis*). Common at St. Mary's Valley in August, and probably breeds in the mountains.

ROCKY MOUNTAIN GOLDEN-EYE (*Bucephala Islandica?*). I saw some dark headed ducks, perhaps this species, which was so long supposed to be peculiar to the Rocky Mountains,

*Yellow-legs (*Gambetta melanoleuca*) were obtained by Dr. Suckley at St. Mary's Valley, in 1853.

high up the Little Blackfoot River, but did not succeed in killing one.

SHELDRAKE (*Mergus Americanus*). I shot a female bird of this species at the highest camp on the Little Blackfoot River, near where it doubtless had raised a brood, as they seek such clear rapid streams for that purpose in the Cascade Mountains. *M. serrator*, the female of which is so much like this, has probably never been obtained far from the coast.

WESTERN GREBE (*Podiceps occidentalis*). I found this Grebe on the Alkaline lakes of the Columbia Plain, October 8th, about the same time of year that I obtained the first known specimen from near Walla Walla, in 1853. Its breeding place may be on the shores of these lakes.—*To be concluded.*

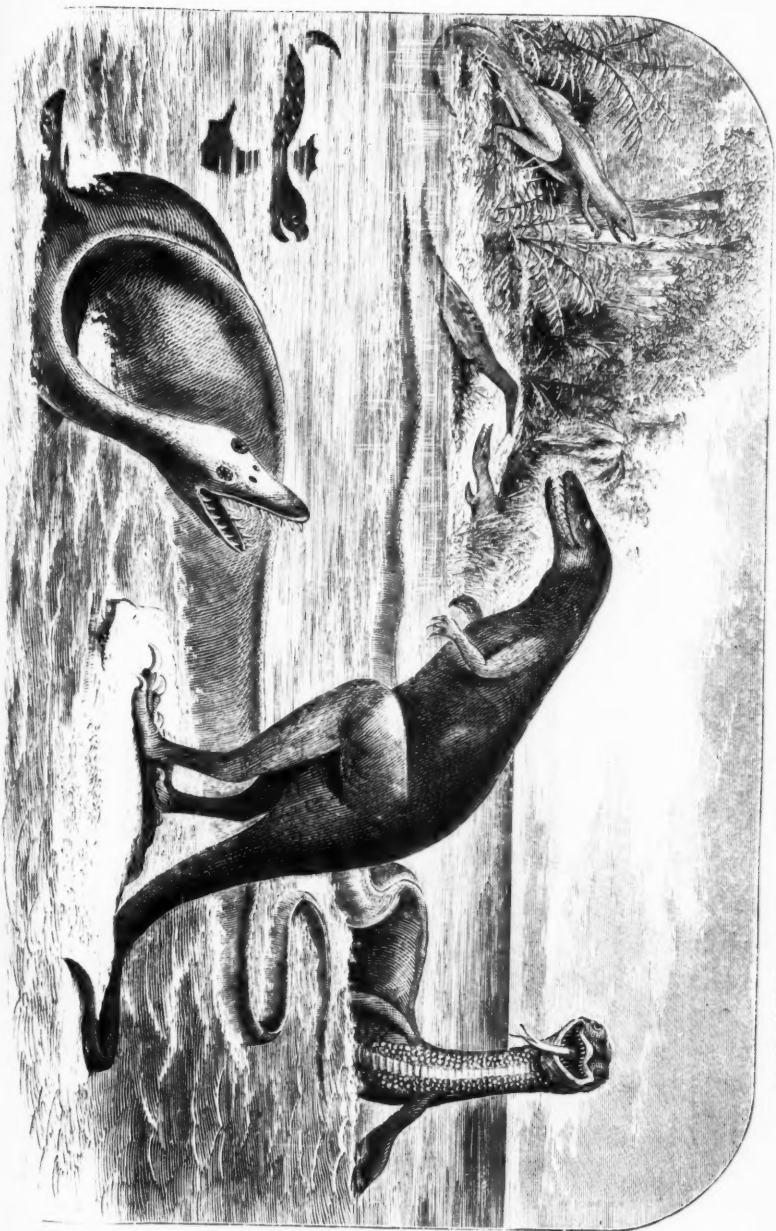
THE FOSSIL REPTILES OF NEW JERSEY.

BY PROF. E. D. COPE.

(Continued from Vol. I, page 30.)

WHILE grim and monstrous Dinosaurs ranged the forests and flats of the coast of the Cretaceous sea, and myriads of Gavials basked on the bars and hugged the shores, other races peopled the waters. The gigantic Mosasaurus, the longest of known reptiles, had few rivals in the ocean. These Pythonomorphs were the sea-serpents of that age, and their snaky forms and gaping jaws rest on better evidence than he of Nahant can yet produce.

Ten species of this group are known from the Cretaceous beds of the United States, of which six have been found in New Jersey. Two others occur in Europe. In relative abundance of individuals, as well as of species, New Jersey is much in advance of any other part of the world where excavations have been made.



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These creatures have been referred to the neighborhood of the Varanidae or Lace-lizards, which now haunt the shores of rivers in the tropics and southern regions of the Old World. Cuvier, Owen and others, have expressed this view, and there has been little dissent from it expressed by paleontologists. They readily constitute, however, a distinct order of reptiles, combining features of serpents, lizards, and Plesiosaurians. This is readily understood by the light of the abundant material discovered in various parts of the United States. The lizard-like affinities are, it is true, to the Varanians rather than to any others.

The *Mosasaurus* was a long slender reptile, with a pair of powerful paddles in front, a moderately long neck and flat pointed head. The very long tail was flat and deep, like that of a great eel, forming a powerful propeller. The arches of the vertebral column interlocked more extensively than in other reptiles except the snakes, presenting in a prolongation of the front of one, which enters beneath that immediately in advance of it, a rudiment of that extra articulation called the "zygospheneal." In the related genus *Clidastes*, this structure is as fully developed as in the serpents, so that we can picture to ourselves its well known consequences: their rapid progress through the water by lateral undulations; their lithe motions on land; the rapid stroke; the ready coil; or the elevation of the head and vertebral column, literally a living pillar towering above waves or brush of the shore swamps. While the construction of the skull was as light as that of the serpents, it was, apparently, not so strong. The sutures are more frequently of the squamosal type, and the brain case was not as fully ossified in front. The teeth, too, are less acute, and therefore less adapted for retaining struggling prey. While the jaws were longer, the gape was not so extensive as in serpents of the higher groups, for the *os quadratum*, the suspensor of the lower jaw, though equally movable and fastened to widely spread supports, was much shorter than in

them. But there was a remarkable arrangement to obviate any inconvenience arising from these points. While the branches of the under jaw had no sutural connection, and possessed independent motion, as in all serpents, they had the additional peculiarity, not known elsewhere among vertebrates (except in a few snakes), of a movable articulation a little behind the middle of each. Its direction being oblique, the flexure was outwards and a little downwards, greatly expanding the width of the space between them, and allowing their tips to close a little. A loose flexible pouch-like throat would then receive the entire prey, *swallowed between the branches* of the jaw; the necessity of holding it long in the teeth, or of passing it between the short quadrate bones would not exist. Of course the glottis and tongue would be forwards. The physiognomy of the reptile, with apparently dislocated jaws and swollen throat, as he passed a Chimæra to his internal laboratory, could scarcely be prepossessing.

The Clidastes and Macrosaurus were the more slender of these heteroclitid beings, while Mosasaurus embraces the most gigantic. The *Clidastes iguanavus* could not have been shorter than thirty feet, and presented a reduction of the length of the paddles, consistent with its thoroughly serpent-like vertebral column. *Macrosaurus validus* considerably exceeded this length. *Mosasaurus Mitchelli* and *M. Missouriensis* propelled sixty feet of length through the waves, while no portion of these have been found to equal the *M. maximus*, which have recently been exhumed.

The reptilian whales of those troublous times, were the Cimoliasaurs and Elasmosaurs. These were the Plesiosaurs of Cretaceous life, and probably had a great range over the earth. Portions of them have been found in England and North America to our far western regions. Cimoliasaurus appears to have resembled Plesiosaurus in general, while Elasmosaurus added to its type an enormous and flattened tail, relatively as long as that of the Mosasaur, or the modern

Iguana, but not so flat as in the former; perhaps it were more as in the Crocodile as to compression, while relatively still longer. But both of these types present one strange feature. The processes which connect the arches of the vertebræ, are related to each other in directions the reverse of that which prevails among vertebrata generally, being perhaps the same as the zygosphen of the serpent and Clidastes, without the usual accompaniment. But the more probable explanation is, that they are the usual "zygapophyses" with the articular faces somewhat altered in direction. They are very oblique, turned a little over from the perpendicular, which latter position is sometimes more or less approached by these processes in other animals.

The *Elasmosaurus orientalis* rests on the evidence of but few remains, but these are like those of its better known congener *E. platyrus*. The vertebræ are nearly as large as those of an elephant, and indicate a totally different type of reptile from the Mosasaurus. The bulk was whale-like, the neck long and flexible, while short paddles and the serpent-like tail, sped this most colossal of our sea-saurians on his destructive career. The skull was light, and with a long narrow, and very flat muzzle; the nostrils or spout-holes were near the orbits; the teeth long and cylindric, and much sharper than those of the Mosasaurus. The most ravenous fish—the Enchodi, or great *barracudas* of the Cretaceous, were his food, and few we might suppose could escape the plunge from the elevated position whence he scanned the waters for prey. *Cimoliasaurus magnus* is more abundant in New Jersey. In bulk it was little inferior to the last, but it was apparently abbreviated and depressed behind, and so must have presented a very peculiar form. Precisely what that was and whether it supported a caudal fluke, we must determine hereafter. *Elasmosaurus platyrus* was forty-five feet in length.

While the crocodiles are most numerous in individuals in the deposits of this period, the turtles exceed them and all

other orders in the number of species. There have been twenty found in the Cretaceous of New Jersey, and three additional ones are known from the Tertiaries of the same State. The Cretaceous turtles may be arranged under four heads, viz., true Emydes or fresh water forms; Chelydrine Emydes, or snappers; Trionychidæ or soft shells; and Hydraspididæ, a type now confined to the Southern Hemisphere, which throw the head round the side of the shell, instead of drawing it in. It will be observed that all of these forms occur at the present day in fresh water only, and that true marine turtles are not found in this part of the Cretaceous formation. Add to this the fact that the crocodiles are rather estuary and river animals; that the Dinosaurs are terrestrial; and that by far the most abundant shells of the same region are oysters and Exogyræ, and we have indicated a condition of occasional separation from the high ocean, by seaward bars and islands, or even by occasional considerable strips of dry land.

The Emydiform turtles all belong to the genus *Adocus* of Cope, and were often of the size of our large gulf species, but generally of far more massive structure. The snapper-like forms are more numerous; they have been taken to be marine types, and indeed their fore-limbs appear to have been more paddle-like than those of the species of our modern rivers. They are represented by nine species, which pertain to five genera. These forms differ much in the relative union of the shield of the carapace, and its marginal pieces. In the genus *Peritresius* of Cope, the margin was largely separate, and the shell covered by a thin skin; in *Lytoloma* Cope the margin was also distinct, except in front and rear, and the carapace was covered by heavier shell-like dermal plates. *Propleura* Cope contained one large species—*P. sopita*, where the margin was broad and flat, and free as in the last, except that it had a broad union with the disc in front. Finally *Osteopygis* Cope, was solidly knit fore and aft by suture between disc and margin. Of its three species,

O. chelydrinus presented sharp points round the circumference, like a snapping tortoise. *O. emarginatus* had open notches between, at the same parts of the margin, and *O. platylomus* was even. *O. emarginatus* was the giant of all the snappers and probably commonly reached a length of six feet. An ally, the *Eucastes platyops*, whose cranium has been found, presented a broad, massive palatal surface, apparently for crushing, rather than the sharp edges and hooked bill of the raptorial snapper. It may have crushed shells for food. The *Lytoloma angusta* Cope shows a similar type of jaws. In the *Eucastes*, the skull measures about a foot in length, and eight inches in width, and accommodated immense temporal muscles, which indicate the power of its bite.

More elegance and less strength characterize the Hydrospid species. Five of these have been described, as follows: *Bothremys Cookii* Leidy; *Prochonias sulcatus* Leidy sp.; *P. strenuus* Cope; *P. princeps* Cope, and *Taphrosphys molops* Cope.

In the first we have a well protected cranium with small eyes, with the Milesian traits of a broad mouth, a pug-nose, and a stiff upper lip. His form seems to combine the capacities of doing as much injury to others and receiving as little himself as possible. What his shell was we do not know, but we know that he could not draw his head into it, by reason of a peculiar structure on the sides of his inner nostril. Of the other genera, the numerous shell fragments tell a similar story. It is only necessary to see whether the pelvis was attached to the lower shell, or plastron, to know whether the cervical vertebræ would form a sigmoid, and be withdrawn into the shell, or a horizontal curve and turn round outside, as a goose rests its head above its wing. Or, if the front part of the plastron only be found, if there be a supplemental plate in the front, we know both the flexure of the neck, the arrangement of the pelvis, and the structure of the nose. Such is a result of the law of correlation,

which holds through long series of forms, but must be carefully modified for other series, and in some points cannot be read at all.

In *Prochonias*, as in the modern genus of Brazil, *Hydro-medusa*, the ileum is fastened by a great suture to the shell above, right on the line of junction of two rib bones. But the bones of the front of the carapace, are quite different from those of *Hydromedusa*. In *Taphrosphys* the structure is more powerful. The rib bones are united into one, and rise up round the sutural scar, leaving it at the bottom of a deep pit. *T. molops* was a powerful swimmer, and perhaps what he lost in mass, was gained in speed. The bony shells of both this genus and the last, are sculptured with netted grooves (*P. sulcatus* and *P. strenuus*) or ribbed lines (*P. princeps*, and *T. molops*), and they were probably covered with a thin skin instead of dermal scales. *P. princeps* was large and massive, equalling some of the snappers.

The more beautifully marked "soft-shelled" forms, the *Trionyches*, are represented by three species. Their position shows that they lived at an earlier period than in Europe. The *Trionyx* of our Miocene (*T. lima* Cope) was large and rough, with narrow sharp ridges. Its remains occur with Dolphins and Porpoises, but it may have been floated or washed from the mouth of a fresh-water stream into such strange company.

The Crocodiles of the modern period are characterized by the hollow crowns of their teeth, and one genus of the Cretaceous, viz., *Botrosaurus* Agassiz, possesses a similar dentition. Most of the Miocene species of both Europe and America possess, on the contrary, solid crowns, composed of closely concentric cones, as we see in *Mosasaurus* and some other reptiles. Some of them have been on this account mistaken for *Mosasauroids*, but none of the latter are known above the Cretaceous. In this country the Miocene forms of this kind are gavials, of even larger size than those of the Cretaceous. They belong to the genus *Thecachampsa* Cope. of

which *T. sericodon* was first discovered by Dr. H. C. Wood in Southern New Jersey, and *T. sicaria* by Philip T. Tyson in Southern Maryland. In both localities their remains are mingled with those of Dolphins and Whales, and their carcases have all floated together on the ocean currents and tides to their present resting places. In Europe there are some species of the same genus, while allies of the true crocodilian form represent the *Plerodon* of Meyer. The gavials of the Cretaceous present a similar character of teeth, and approach remarkably near to the *Thecachampse*, when we consider the great hiatus between the life of the two great periods in other departments. The gavials of the Miocene differ in but a few important points from the *Thoracosauri* of the Cretaceous. The latter were very numerous in individuals, and appear under five specific forms.

In the plate accompanying this article, the artist has attempted an ideal representation of a few of the subjects which haunted the shores of our country, when our prairies were the ocean bottom, and our southern and eastern borders were far beneath the Atlantic. *Laelaps aquilunguis* occupies the foreground on a promontory, where his progress is interrupted by the earnest protest of an *Elasmosaurus*. *Mosasaurus* watches at a distance with much curiosity and little good will, while *Osteopygis* views at a safe distance the unwonted spectacle. On the distant shore a pair of the huge *Hadrosauri* browse on the vegetation, squatting on their haunches and limbs as on a tripod. *Thoracosaurus* crawls up the banks with a fish, and is ready to disappear in the thicket.

INSECTS INJURIOUS TO THE POTATO.

BY HENRY SHIMER, M. D.

OF the several distinct species of potato bugs, the Colorado Beetle (*Doryphora 10-lineata* Say, Fig. 13; *a*, eggs; *b*,

young and fully grown larvæ; *c*, pupa; *d*, beetle; *e*, left wing cover, magnified; *f*, leg, magnified) has chiefly attracted attention at the West during the few years past. It has been very destructive, hence anything bearing upon its habits is

Fig. 13.



interesting to farmers. Last year they were more numerous in Illinois than at any other time. Whole acres were entirely destroyed by them. The autumn following the early frosts that killed the potato vines, was one of the finest we ever enjoyed. This unusually late pleasant weather induced the pupæ of the last brood of the Colorado Beetle to mature and come out of the ground instead of remaining in over winter, and the lack of food in the fall, together with the cold open winter, contributed greatly to their destruction. From this one can easily see their assailable points, and devise means for holding them in check. It is manifest that this can be done most effectually by the concerted action of the farmers of the whole country. I think it needs no argument to prove that it would be better for the entire North-west, so far as the Colorado Beetle has extended, to abstain from planting potatoes for one year, than to be annoyed as they have been in Iowa and Illinois during the few past years. Or, perhaps, it might be as effectually managed by planting only early-

maturing varieties; planting these early one year, and digging the potatoes in August; then in the following year farmers might plant about the first of July, and take them up after the frost kills the vines. By this course of treatment these potato bugs will be without food during the first fall, and many will perish, while those that remain in the ground over winter will come up in May, and be without food more than a month in the spring, and thus perish. This plan rigidly followed will restrain, if not exterminate the bug.

To this argument some may reply that the potato bug will feed on other species of the natural botanical family Solanaceae, such as the tomato, thorn-apple, etc. It is true that they will eat of these to some extent, especially the hungry half-grown larvæ, but I have observed carefully, and never in this region saw the young potato bugs developing from the eggs laid on these plants, though I have occasionally seen eggs on tomato plants.

Early in the last spring a sufficient number of mature potato bugs appeared on the potato vines to cause some apprehensions of trouble, though much less than in the preceding year. The larvæ appeared as usual, and early potatoes were partially trimmed by them, from which I inferred that the second brood would do a good deal of damage in July and August.

About the middle of July I saw potato bugs in Minnesota, as far north as St. Paul. They were quite abundant, the larvæ stripping the vines as they had done in Illinois last year. I was at home in Illinois in August, and sought for the potato bugs on the same grounds that were entirely overrun by them last year, and found very few. At the last of August, I searched in the potato patch, on these same grounds, and found but two mature bugs and one small bunch of eggs. Here is a remarkable and unexpected decrease of bugs, instead of the usual increase, that makes them very destructive in August. How are we to account for it? The various known heteropterous enemies, and Lady-birds,

(Fig. 14, *Coccinella 9-notata* and pupa; fig. 15, *Hippodamia 13-punctata*; a, larva; b, pupa) without doubt destroyed some, but as I could not find them more numerous than usual,

Fig. 14.



I cannot admit that they were the chief means of this almost perfect extermination of potato bugs. Moreover the larvæ in June were sufficiently numerous, in proportion to the number of beetles observed in the spring, and

Fig. 15.



yet in July and August the beetles failed to appear as expected. We can only look to climatic causes as the principal means that prevented the spring brood from maturing.

The weather here was uncommonly *hot* as well as dry, hence the pupæ were exposed to the burning dry dust, and this doubtless was the efficient cause of the death of the soft, naked, delicate pupæ. The only object that they can have in entering the ground to transform, is protection from the hot dry atmosphere of summer and the cold frosts of winter, for they will transform well enough above ground in a paste-board box in a room, as I proved in hundreds of examples during the series of observations I made on the breeding of these insects in 1865, and reported in the "Practical Entomologist." The ground usually furnishes a cool moist place, but this time it failed to favor them, hence they perished.

I have often observed that the pupæ of various insects perish from exposure to too much evaporation. The pupæ of the various wood-borers however, carefully handled, will not develop so well in a paper box as in the hole they make in the tree, and many of them dry away entirely; this I have often observed, and very forcibly this summer, in the examples of the new species of beetle, that I have bred from the prickly ash tree; also the three varieties of beetles, bred from the several borers, or "grubs," found in the grape-vine, reported to the Academy of Natural Sciences, Philadelphia. This same drying away of the pupa I have often noticed

in attempting to breed the Maple Worm (*Dryocampa rubicunda*). The larva retires to some cool moist place beneath a board, stone, or anything it can find on the ground, where it will not be exposed to the dry atmosphere, for the chrysalis is naked. Now take this same chrysalis and put it into a dry box, and it most likely will perish, and fail to perfectly develop. Many lepidopterous larvæ protect themselves with an impervious cocoon where they are exposed to atmospheric vicissitudes. This, I believe, is not only to protect them from the rain, if it is at all for this purpose, as entomologists often suppose, but to protect them from the far more injurious influence of evaporation during the long time they take no liquid nourishment. It is for this purpose also that the Cecidomyian larva cements its spun cocoon with a gummy fluid, as I have shown in the "Transactions of the American Entomological Society," for October, 1867. We therefore find here another example of climatic causes, producing disease and death among insects in a wholesale manner.

Entomological writers usually represent cannibal insects as the most efficient means in nature for the extermination of injurious insects, and in the reports of State Entomologists we occasionally find them speaking in glowing terms of the power that man can exert in controlling injurious insects. While we may not despise these measures of protection, especially the former—for without the Ichneumon fly, the Syrphus fly, the Coccinellæ, etc., we would doubtless be overrun by swarms of caterpillars, plant-lice, and other noxious depredators—let us not forget the great truth, that climatic causes, producing death by epidemic diseases and various other means, are infinitely in advance of most other natural means of exterminating noxious insects (for my extended views and observations on this topic, see an address before the Northern Illinois Horticultural Society, and published in the first volume of the Transactions of that body, and my Report of a remarkable epidemic disease observed among

Chinch-bugs, in the Proceedings of the Academy of Natural Sciences of Philadelphia, for May, 1867).



Fig. 16.

In the case of the Chinch-bug, the conditions favoring its development and health are entirely the reverse. It was during the unusually wet weather of 1865 that the great epidemic referred to prevailed, and at the same time the Colorado potato bug flourished and multiplied as favorably as it could desire; but this year was one favorable to the development of the Chinch-bugs, and true to nature, they have increased so that a few can be found again. Since I observed this failure of development among the potato bugs, I have looked carefully for them in this (Carroll) and parts of the adjoining counties, and seldom find a patch with any bugs. At this date the early frosts have



Fig. 17.

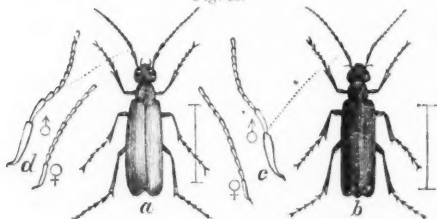


Fig. 18.

already killed the potato vines, hence their autumnal supply of food being cut off we may expect a still more complete destruction of the bugs if the next autumn should be nearly as pleasant as the last.

Of the Blistering Beetles (*Cantharidae*), I have observed this year the Striped Cantharis (*Lytta vittata* Fabr., Fig 16) unusually abundant, and quite injurious to potato vines, beet leaves, etc. The Margined Cantharis (*Cantharis marginata* Oliver, Fig. 17) were also moderately abundant, injuring beets most. I also observed some of the Ash-colored Cantharis (*Lytta cinerea* Fabr., Fig. 18, *a*, male), and the black Cantharis (*Lytta murina* Leconte, Fig. 18, *b*) on potatoes and beets. A species of Oil Beetle (*Meloe angusticollis*, Fig. 19) was also abundant, eating potatoes, beets, etc., and injuring tomato fruit very much. Farmers all about

this region have complained bitterly of a "new long potato bug," alluding to these Cantharides, having forgotten in the midst of the injuries caused by the Colorado potato bugs for several years, that these blistering beetles had ever injured potato vines.

The reports coming in from localities all around me were that these Cantharides were much more injurious than the Colorado bugs; that potatoes were greatly injured, and beet crops entirely ruined in many instances; and this accords with my observations about home.

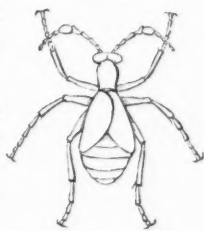


Fig. 19.

These Cantharides are not very particular about the choice of food. Although they doubtless prefer the potato, beet, golden-rod, etc., yet sooner than be without food, they will devour almost any kind of vegetable that comes in their way. I have seen the Ash-colored Cantharis doing well on locust leaves; also on common red field clover, etc., and have lately, for a wonder, seen the Black Cantharis feasting on the leaves of a common noxious weed, sometimes called lamb's quarters, pig-weed, etc. (*Chenopodium album* Linn.), for injurious insects are almost sure to eat the useful vegetation in preference to weeds.

After thus observing the workings of nature's plans, I am convinced that she will in due time take care of the Colorado potato bug, as she has of the Cantharides during all past time.

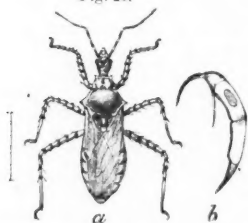
NOTE. — Since communicating the above, I spent two weeks last autumn in travelling in Eastern and Middle Iowa, and learned some facts, the most reliable being developed out of the history of the general good potato crop, as evinced by the price in the digging season. Potatoes at Mount Carroll, Ill., were 50 cents a bushel; at Morseville, Joe Davis County, Ill., 50 cents; at Rock Island, Ill., 60 to 70 cents. In Iowa, at South Amenon, 30 to 35 cents; at Marengo, 50 cents; State Centre, 30 to 35 cents; Grundy County, 25 to 30 cents; and thus prices ranged all along wherever I went. The Colorado potato beetle had been very injurious.

All through these places for several years farmers all were discouraged with attempting to raise potatoes, and therefore did not plant largely; some abandoned the crop in disgust. The above figures I obtained from parties buying and selling, and learned from them that potatoes were abundant.

I invariably inquired of farmers regarding the Colorado potato beetle. They all knew it very well, but explained the cause of its diminution, by supposing that it had passed by them, travelling north and east; forgetting that insects travel in search of food and breeding grounds, and not to make money, see the country or their friends, or for any other pleasure, as does the human animal. They all knew that the bugs were plenty in the spring, but not in midsummer and autumn. As this peculiar phenomenon in the history of the Colorado potato bug was the same as above noted at my home, I am persuaded that it was due to the same cause, in a slight degree to insect enemies, but chiefly to climatic causes, *i. e.*, the *hot dry weather*.

I am now convinced beyond a doubt, that the dryness of the summer was the only efficient restraining cause, although my friends Messrs.

Fig. 20.



Walsh and Riley differ entirely from this view. See the "American Entomologist," (Vol. I, Nos. 2 and 3) where they figure quite a host of the enemies of the Colorado potato bug, some of which are inserted in the present article, but do not even notice the great climatic enemy that worked so faithfully and effectually everywhere during the past summer.

I appreciate with much gratitude the small part of the work done by these "bug foes,"

and I hope that the editors and authors will excuse a passing review. Lady-birds doubtless eat the eggs of some potato bug, but many such reports came to my ears through farmers and

agriculturists and were not at all reliable. Unfortunately, as I have observed, Lady-birds will devour Lady-bird's eggs about as frequently as

any other eggs, and none but entomologists observe the difference, hence I seldom notice such reports, at least in print, without personal investigation. The Many-banded Robber (*Harpactor cinctus* Fabr., Fig. 20) will not do much work, for, although they will eat some larval potato bugs (just as a cat will eat some bread) when hard pressed for food, yet they will perish of hunger when confined in a box with young Colorado potato bugs, as I have demonstrated, thus proving that they must have other and better food. The very same, probably, may be true (reasoning from analogy) of their other principal heteropterous enemy, the Spined Soldier-bug (*Arma spinosa* Dallas, Fig. 21; *a*,

its beak; *c*, the beak of the *Euschistus punctipes* Say, which closely resem-

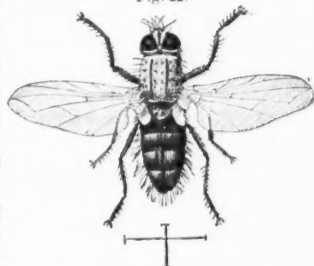
Fig. 21.



bles the *Arma*). This, however, I never have subjected to the crucial test of boxing up with the beetle, but have never seen it feeding on them in nature, nor found them more abundant in potato patches than elsewhere.

The authors, from their correspondents, publish as "no doubt indisputable," that the Blister Beetles frequently feed on potato bugs. This same idea entered my head when I saw the potato bugs so scarce, and the blister beetles, especially the striped one, so very abundant on our potatoes. To test it, I put a few Striped Blister-beetles into a breeding jar, with one small bunch of potato bug eggs (all I could find) and a potato stalk for food. The eggs hatched in a day, and the young Colorado bugs lived in harmony among their "formidable" associates, until the potato vine moulded away. The Blister-beetles perished first, of starvation, without destroying one of the larvæ. This little experiment, although

Fig. 22.



not as extended as I could wish, yet inclines me to be skeptical about the matter. Their parasitic fly (Fig. 22, *Tachina*) is entirely new to me, and I hope is a more important enemy than all the others. While I was breeding great numbers of potato bugs in 1865, preparatory to the paper I published in 1866, in the "Practical Entomologist," on this subject, I failed to find anything of this kind here; since then I have not searched for it. Their pa-

per is full of interest, yet to the practical man does not give very much substantial encouragement except in recommending the old-fashioned tedious way of picking the bugs by hand, as in reality this is about all man can do.

Before closing this already long note, allow me to place among the list of insect enemies a *Philonthus* which is undescribed, according to Mr. Walsh, who received the specimen from me. This specimen, in the summer of 1865, I found as an intruder in one of my breeding boxes, containing a number of Colorado potato bug larvæ. When found, it had maliciously killed all the larvæ, just as a weasel or mink will kill more chickens than it needs for food. This insect was a medium sized member of the family *Staphylinidae*, a *Brachelytrous* beetle. It was black, with short wing-cases. This fierce and powerful insect, individually, is the most terrible enemy of the Colorado potato bug extant among insects, and I hope that some day it will be honored with the name of the Prairie State, with credit for an efficient worker.

NOTE.—Cuts 13, 15, 16, 17, 18, 20, 21 and 22, are from the "American Entomologist."

REVIEWS.

THE PAMPAS AND ANDES.*—When one considers that this pedestrian feat was performed by Mr. Bishop when only seventeen years old, unaided by influential friends, having no money, and no knowledge of the language, and for a time sustaining himself by his own labor, one must confess an admiration for the boy's pluck. A perusal of the book shows how one will brave a thousand dangers when impelled by a love of nature. Many interesting facts are given regarding the habits of the natives, the physical features of the country, etc. Some errors which have found their way into our text books are corrected. We find, for instance, that no such place as Uruguay is known in South America. The province, incorrectly called Uruguay on our maps, is properly called Banda Oriental. An interesting account is given of a species of marmot, which burrows in the pampas as our prairie-dog does in the West: "Its habits are similar to those of the proper marmots; in size it exceeds the opossum of North America." They are found all over the pampas, as far south as Patagonia. And strangely enough the burrows are occupied by a small owl known by the name of the Burrowing owl of South America. As an account has already been given in the NATURALIST of the Burrowing owl of the West, we subjoin Mr. Bishop's account of the companion species in South America:

"I first met with this owl on the banks of the River San Juan, in the Banda Oriental, one hundred and twenty miles west of Montevideo, where a few pairs were observed devouring mice and insects during the daytime. From the river, travelling westward thirty miles, I did not meet a single individual, but after crossing the Las Vacas, and coming upon a sandy waste covered with scattered trees and low bushes, I again met with several.

"Upon the pampas of the Argentine Republic they are found in great numbers, from a few miles west of Rosario, on the Parana, latitude $32^{\circ} 56'$ south, to the vicinity of San Luis, where the pampas end, and a travesia or saline desert commences.

"On these immense plains of grass it lives in company with the *bizcachá*. The habits of this bird are said to be the same as those of the species that inhabits the holes of the marmots upon the prairies of western North America. But this is not strictly correct, for one writer says of the northern species, 'we have no evidence that the owl and marmot habitually resort to one burrow;' and Say remarks that 'they were either common, though unfriendly, residents of the same habitation, or that our owl was the sole occupant of a burrow acquired by the right of conquest.' In this respect they differ from their South American relatives, who live in perfect harmony with the *bizcachá*, and during the day, while the latter is sleeping, a pair of these birds stand a few inches within the main entrance of the burrow, and at the first strange sound, be it near or distant, they leave their station, and remain outside the hole, or upon the mound which forms the roof of the domicile. When man approaches, both birds mount above him in the air, and keep uttering their alarm note, with irides dilated, until he passes, when they quietly settle down in the grass, or return to their former place.

"While on the pampas, I did not observe these birds taking prey during the daytime, but at sunset the *bizcachás* and owls leave their holes, and search for food, the young of the former playing about the birds as they alighted near them. They do not associate in companies, there being but one pair to each hole, and at night do not stray far from their homes.

*The Pampas and Andes. A Thousand Miles' Walk across South America. By Nathaniel H. Bishop. Lee & Shepard. Boston: 1869. 12mo.

"In describing the North American burrowing owl, a writer says that the species 'suddenly disappears in the early part of August,' and the 'species is strictly diurnal.'

"The *Athene cunicularia* has not these habits. It does not disappear during any part of the year, and it is both nocturnal and diurnal, for though I did not observe it preying by day on the pampas, I noticed that it fed at all hours of the day and night on the north shore of the Plata, in the Banda Oriental."

ONE THOUSAND OBJECTS FOR THE MICROSCOPE.*—This is an exceedingly useful little work for the beginner in microscopy. It has twelve plates of figures, with explanations in the text, and although the figures are none of the best, they are better than the price of the book would seem to justify.

A GUIDE TO THE STUDY OF INSECTS.†—The Fifth part completes the account of the butterflies, and describes the more typical moths, as far as the family of Geometrids. It contains two plates, a full-page illustration, and sixty woodcuts. The "Guide" will contain ten plates, and be completed in five more parts, the tenth part to contain an Entomological Calendar, a Glossary of Entomological terms, and a copious Index.

THE RECORD OF AMERICAN ENTOMOLOGY, 1869.—A sufficient number of subscriptions have been received to warrant its publication, but as the book will be larger than at first thought, the price will be raised to \$1.00. Original subscribers at 75 cents, will receive their "Record" without extra charge. (The name has been changed from *Annual* to *Record*).

APPLETON'S ILLUSTRATED ALMANAC FOR 1869.‡—A pleasing feature of this annual is twelve cuts, illustrating the game-birds of this country, characteristic of each month.

NATURAL HISTORY MISCELLANY.

BOTANY.

BOTANICAL NOTES.—In the autumn of 1867 I collected on the shore of Lake Erie, near North East, Pa., a very marked variety of *Scirpus sylvaticus* Linn., var. *atrovirens*?. Instead of spreading rays bearing the heads of spikes, as is usual in this species, the heads of the plants that I found were collected in a dense globular mass, about one inch in diameter. The rays were either very short, or there were none at all. The scales and fruit are similar to those of the common variety. This curious form was not the result of a dwarfing of the plants, for they were of a very robust habit, two to three feet high, with wide leaves and a stout culm. I propose calling it var. *sychnocephala* if not already named. I found them

*One Thousand Objects for the Microscope. By M. C. Cooke. 12mo. London, 1869. 1s.

†A Guide to the Study of Insects, and a Treatise on those Injurious and Beneficial to Crops. For the use of Colleges, Farm Schools and Agriculturists. By A. S. Packard, jun. Parts 1-5. 50 cents each. To be published in ten parts. Published by the author, Salem, Mass.

‡Appleton's Illustrated Almanac, 1869. For sale by H. A. Brown & Co., 3 School st., Boston.

growing a few feet from the edge of the water. Is this form found in other places?

I have collected from the same rootstock (I think) in two successive years, two specimens of *Trillium erythrocarpum* Mx., with pistillate flowers and nine petals. The extra petals took the place of the stamens, and were colored like the others, but were somewhat smaller in size.—S. N. COWLES, Otisco, N. Y.

THE CEDARS OF LEBANON.—Dr. Hooker makes the following interesting communication to a recent number of the "Gardeners' Chronicle":—"The Rev. M. Tristram, F. L. S., informs me of a most interesting discovery lately made in the Lebanon, viz., of several extensive groves of cedar trees, by Mr. Jessup, an American missionary, a friend of his own, to whom he pointed out the probable localities in the interior. Of these there are five, three of great extent, east of 'Ain Zabalteh,' in the southern Lebanon. This grove lately contained 10000 trees, and had been purchased by a barbarous Sheikh, from the more barbarous (?) Turkish government, for the purpose of trying to extract pitch from the wood. The experiment of course failed, and the Sheikh was ruined, but several thousand trees were destroyed in the attempt. One of the trees measured fifteen feet in diameter, and the forest is full of young trees, springing up with great vigor. He also found two small groves on the eastern slope of Lebanon, overlooking the Buka'a, above El Medeuk: and two other large groves containing many thousand trees, one above El Baruk, and another near Ma'asiv, where the trees are very large and equal to any others: all are being destroyed for firewood. Still another grove has been discovered near Duma, in the western slope of Lebanon, near the one discovered by Mr. Tristram himself. This gives ten distinct localities in the Lebanon, to the south of the originally discovered one, and including it. Ehrenberg had already discovered one on the north of that locality, and thence northwards the chain is unexplored by voyager or naturalist."—*Quarterly Journal of Science, London.*

ZOOLOGY.

THE CROW A BIRD OF PREY.—In confirmation of what Mr. Naumann has stated in regard to the crow as a "bird of prey," Mr. H. G. Bruckart, of Silver Spring, Lancaster County, stated before the Linnaean Society, of Lancaster City, at its January meeting, that in his neighborhood it is not an uncommon occurrence, and especially not in the spring of the year, when they have had a winter's fast, and hens take their young broods abroad. Indeed he has known them to venture into barn-yards, and carry off young chickens. We know that the corvine appetite craves the eggs of other fowls, and this characteristic is only a farther advance in that direction. We have now a formidable "Crow Roost" on the Conestogo, in this county, about six miles south of Lancaster City, but with their usual cunning, I have not yet learned that they "tease sheep near

home." The gentleman upon whose farm the "roost" is located, says they rise up every morning, and after forming four divisions, the one flies east, another west, another north, and another south, returning again in the evening. About the same number fly in these same directions, and about the same hours every day.—S. S. RATHVON.

HOW TO COLLECT MYRIAPODS.—The following letter from the late Mr. Newport of England, was written to his friend, Mr. Doubleday, of the same country. The latter had volunteered the services of Dr. T. W. Harris, with whom he had formed a close intimacy during his sojourn in this country, in collecting material to aid Mr. Newport in his studies upon the Myriapods. Mr. Newport was one of the highest authorities in this group. As it gives, in a familiar form, the more important directions necessary for collecting Myriapods (Centipes, etc.), we publish it hoping to call attention to these interesting animals. Those who wish to study our native species, are referred to the papers of Dr. Wood, in the Proceedings of the Academy of Natural Sciences of Philadelphia, and in the Transactions of the American Philosophical Society, 1865.

10 UPPER SOUTHWICK STREET, }
CAMBRIDGE TERRACE, Dec. 22, 1842. }

MY DEAR SIR:—In accordance with your suggestion, I now send you a few observations respecting those Myriapods which I so much desire to possess. You are aware that I should be delighted to obtain any specimens of Myriapods from the United States, and that the *localities* being added would make them much more valuable. I would suggest that in-

Fig. 23.



stead of drying the specimens, the whole be preserved in strong spirit, as a great many may be stowed away in that manner without receiving any injury, and can afterwards be dried, if required, as specimens for the cabinet. As far as my own wishes are concerned, I would much prefer all specimens in spirit, and should be greatly obliged by having as many specimens, even of the same species, as can be collected. There cannot be too many, especially of the true *Scolopendra*, *Cermatia*, *Lithobii*, *Glomerida* and *Polydesmida* [Fig. 23, *Polydesmus erythropygus* Brandt]. The last two of

Fig. 24.



these families, owing to the great hardness and impenetrability of their tegument, do not preserve well, unless the spirit can be made to enter their interior. I would suggest, therefore, that every specimen of these two families, as well as of the true *Juli* [Fig. 24, *Julus multistriatus* Walsh] and the *Cermatia*, or Shield-bearers, be once or twice pierced with a strong needle in the middle and posterior parts of the body, to allow the spirit to enter. They would then be well preserved and fit for an examination of their interior anatomy, which is my object in obtaining many specimens of the same species. If I understood you rightly, the *Cermatia* are very common in America. I am exceedingly glad, as I cannot yet

obtain any of these specimens for dissection. I am not aware whether any of the large Glomeridae, the proper Sphaerotheridae of Brandt, are found in America, as I should expect they might be. These would be

Fig. 25.



very desirable. You are quite aware that young and immature specimens are often found more easily, and in greater numbers, than the full grown and more perfect specimens. This is especially the case with the Myriapoda, which often swarm in the immature state under the rotten bark of trees or felled timber. Now these *very young* specimens, of all species, are too much neglected by naturalists, and I am particularly desirous of obtaining them. I would recommend that a large quantity of the *very smallest Scolopendra* [Fig. 25, *Scolopocryptops 6-spinosa* Say; from Iowa], Scutigerae or *Cermatia*, Polydesmidae, Cryptops, and Juli be collected. If your friend Mr. Harris could obtain them for me, I should feel greatly obliged. The state in which these species are most interesting to me is when they do not exceed *one-fourth* or *one-half* of an inch in length. My usual mode of collecting the young Lithobii, of this country,

is to have one or two phial bottles filled with rectified spirits of wine, and when I see any of the little mortals running away and about to give one *leg bail*, just to wet my finger

Fig. 27.



with saliva and place it upon them, when, of course, they adhere to it and are easily washed off by placing my finger on the mouth of the phial and shaking the spirit against it; or by washing the finger in the spirit itself. If your friend, by chance, should meet with any eggs of the Shield-bearers, or other genera, they would be very desirable, and would, I have no doubt be perfectly preserved in phials filled with light mould. The young *Scolopendra*, or *Lithobius* [Fig. 26, *L. Americanus* Newp.], or *Cryptops*, or Scutigerae, must not be put together *alive* in the same phial, as they destroy each other, but the large *Scolopendra* may be preserved alive, singly, in wooden boxes, with moistened earth, for several weeks, especially if the earth be impregnated with animal matter. I should be very glad to obtain the *Polydesmus Virginianensis* of Drury (*Fontaria Virginianensis* of Gray), and all of these species may be placed together in tin or

wooden boxes, without injuring each other, if, supplied with some vegetable mould, rotten leaves, or bark. As a general rule, all the true Chilognatha may be placed together, but the Chilopoda, with the exception of the Geophili, destroy each other. The Geophili [Fig. 27, *Geophilus bipuncticeps* Wood; from Iowa] I preserve in bottles with vegetable mould and rotten bark, enclosing the mouth of the phial with a piece of bladder,

Fig. 26.



which keeps the specimen secure, and at the same time admits sufficient air for respiration. In this way I have preserved *Geophilæ* in the same phial with *Juli* for many months, and it is better than closing the bottle with a cork.

I think, my dear sir, I have now given you a pretty good list of my desiderata, but I would also, just add, that a collection of *Scorpions* and *Phalangidae* would be equally acceptable. Of these things, as well as of the *Myriapods*, I would suggest that the very smallest, as well as the very largest specimens of the same species, be collected and preserved in the same way in spirit. In all cases, if the weather be warm, the spirit should be changed when the specimens have been in it for about a month, otherwise they may become rotten and unfit for dissection.

With many thanks for your kindness, I remain, dear sir,

Yours, faithfully,

GEORGE NEWPORT.

E. DOUBLEDAY, Esq.

ON THE DRUMMING OF THE RUFFED GROUSE.*—A writer in "Harper's Magazine" for October, in an article which he heads "Our neighbors the Birds," in speaking of the drumming of the ruffed grouse, says: "the bird resorts to a fallen trunk of a tree or log, and while strutting like a male turkey, beats his wings against his *sides* and the *log* with considerable force."

It is a strange thing that a writer who seems to be familiar with birds should make such a statement. He is not singular, however, in this matter, for most if not all writers whose statements I have examined, seem to be of opinion that the drumming is produced by beating the log or their bodies with their wings; neither of which operations could possibly produce the *hollow* sound which the bird produces. I have not access to Audubon's works, and do not know his opinion. So good an observer as he was is not likely to be mistaken in the matter, and I should like to know his opinion.†

The writer in Harper is mistaken when he says the grouse drums while strutting, like a turkey. He stands perfectly still and erect, stretching himself as high as possible, and produces the drumming sound by striking the *convex surfaces* of his *outstretched wings together behind his back*, just as you often see boys swinging their outstretched arms behind them, so as to make the backs of their hands meet behind, and opposite the spine. This is the truth and the whole matter.—DR. RUFUS RAYMOND, *Brookville, Ind.*

* Communicated to the Smithsonian Institution.

† Audubon, on page 216 of Vol. I of his Ornithological Biography, says, "The drumming is performed in the following manner: The male bird, standing erect on a prostrate decayed trunk, raises the feathers of its body in the manner of a turkey-cock, draws its head towards its tail, erecting the feathers of the latter at the same time, and raising its ruff around the neck, suffers its wings to droop, and struts about on the log. A few moments elapse, when the bird draws the whole of its feathers close to its body, and stretching itself out, beats its sides with its wings, in the manner of the domestic cock, but more loudly, and with such rapidity of motion, after a few of the first strokes, as to cause a tremor in the air not unlike the rumbling of distant thunder."—EDITORS.

HATCHING OF THE SEVENTEEN-YEAR CICADA.—With reference to the eggs and young of the Seventeen-year Cicada, your correspondent from Haverford College, Philadelphia, is not the only one who has failed to produce the young, by keeping branches containing eggs in their studios. I so failed in 1834 and 1851, and indeed I have never heard that any one has succeeded in that way, who has kept them for any great length of time. In the brood of 1868, the first Cicadas appeared here in a body, on the evening of the 2d day of June. The first pair *in coitu*, I observed on the 21st, and the first female depositing on the 26th of the same month. The first young were excluded on the 5th of August. All these dates are some ten days later than corresponding observations made by myself and others in former years. On the 15th of July I cut off some apple, pear and chestnut twigs containing eggs, and stuck the ends into a bottle containing water, and set it in a broad shallow dish also filled with water, the whole remaining out of doors exposed to the weather, whatever it might be. The young continued to drop out on the water in the dish, for a full week, after the date above mentioned. I could breed no Cicadas from branches that were dead and on which the leaves were withered, nor from those that from any cause had fallen to the ground, and this was also the case with Mr. Vincent Bernard, of Kennet Square, Chester County, Pa. After the precise time was known, fresh branches were obtained, and then the young Cicada were seen coming forth in great numbers, by half a dozen observers in this county. As the fruitful eggs were at least a third larger than they were when first deposited, I infer that they require the moisture contained in living wood to preserve their vitality. When the proper time arrives and the proper conditions are preserved, they are easily bred, and indeed I have seen them evolve on the palm of my hand. The eyes of the young Cicadas are seen through the egg-skin before it is broken.—S. S. RATHVON, Lancaster, Pa.

PREPARATION OF BIRD'S EGGS.—The season for collecting eggs has now commenced, and it may be of interest to those engaged in oölogy to know the best method of preparing the egg for the cabinet. As a writer in this journal (Vol. II, p. 487) has gone somewhat into detail on this subject, I will only add the more recent improvements in this branch of Natural History. Until within a few years eggs were blown with two holes, one at each end, or two holes in the side, as seen in the drawing on p. 487, Vol. II. Now, oölogists desire the egg blown with only one hole, and that on the side. This is the only way now adopted by our best collectors. By placing the hole downward nothing but the perfect egg is visible; or what is still better, place the number (according to the Smithsonian Catalogue) over the hole, with the number in sight; then every person, whether familiar with oölogy or not, can tell the egg by referring to the catalogue. The common blowpipe is generally used to remove the contents of the egg. If the hole is a little larger than the point of the blowpipe, the inside passes out around the instrument. If the aperture is no larger than the point, by forcing air into the egg, and

withdrawing the pipe, a part of the contents will follow, and by repeating the process several times you can empty the shell. Then fill the blowpipe with water and force it into the shell several times, shake it well, and then blow out the water; repeat it until it is perfectly clean. Be very particular, especially with white eggs, or dark spots will appear after a time, which make the egg worthless. It was while I was blowing a box of about one hundred eggs of Wilson's Tern (*Sterna Wilsoni*) that Mr. Ellsworth suggested to me a new invention for blowing them. The result is, I can now prepare one hundred eggs in less time than I formerly could ten, and much better, doing all the work with my hands that heretofore has been a severe tax upon my lungs. I will not now describe the instrument, but will say, in brief, that it is invaluable to the oölogist. I would not part with mine for ten times the cost (\$3.10) if I could not replace it. This is the testimony of all who have used them. If any collector wishes to obtain this valuable instrument, the inventor, Mr. E. W. Ellsworth, of East Windsor Hill, Connecticut, will supply them.

—WM. WOOD, *East Windsor Hill, Conn.*

THE VISION OF FISHES AND AMPHIBIOUS REPTILES.—M. F. Plateau has advanced the theory "that these animals can see distinctly in the air, and that their distance of distinct vision must be nearly the same in this medium and in water. Although fishes, with the exception of some privileged species, such as the Eel, the Chironectes, and the Climbing Perch, have hardly any need for combining the faculty of seeing distinctly in water with that of seeing distinctly in the air, this double faculty is evidently indispensable to the Amphibia."—*Annals and Magazine of Natural History*.

FLIGHT OF BIRDS.—Will you inform us how sailing birds remain suspended in the air? Last summer while standing with Prof. Mudge, on the high bluff of the Kaw, opposite Manhattan, Kansas, a large bird, supposed to be *Cathartes aura*, rose from the opposite margin of the river, and accomplished a spiral flight of over five minutes duration, supposed to be more than five hundred feet in height, and a mile in linear extent, against a wind blowing about "three" on the Smithsonian scale, without flapping his wings but *once*, and that was apparently to preserve his balance.

The following suggestions have been made: 1. Birds in sailing do not rise above the initial point, but use their wings as parachutes, like the flying squirrel. The turkey buzzard, mentioned above, rose about three times as high as the bluff. 2. Extended sailing like this is due to the momentum gained by previous flight. The turkey buzzard in this case rose from a perch at the river's brink. 3. Short quills under the wings are used, while the wings proper are stationary! 4. Birds sail against the wind like ships. The resultant force of the sail and keel may be resolved into two forces, one lying in the line of direction of the ship's path. How with birds? Do not sailing birds accomplish the spiral flight when the air is comparatively still? 5. The air raised to a temperature

of 103° Fahr. by the heat of the bird, fills the quills, hollow bones and cavities of the body, and buoys it up. Shoot a hawk or buzzard while sailing, and down he tumbles from his airy perch. Does his body cool as soon as that?

Not one of these suggestions seems to be sufficient. Do they when combined? Will you please enlighten us?—JOHN D. PARKER, *Topeka, Kansas*.

DEEP-SEA DREDGING NORTH OF SCOTLAND.—DRS. W. B. CARPENTER and WYVILLE THOMPSON report to the Royal Society that the recent dredging expedition to the Farøe banks has "obtained evidence of the existence, not of a degraded or starved out residuum of animal life, but of a rich and varied fauna, including elevated as well as humble types, at a depth of 530 fathoms." "Their researches have conclusively established the existence of a temperature as low as 32° over a considerable area of sea bottom, where the depth was 500 fathoms and upwards, notwithstanding that the surface-temperature varied little from 52°." They argue that there is a stratum of sea water with a temperature of 32°, or even 28°, and the existence of such strata even in equatorial regions, has been regarded by high scientific authorities as proving the existence of deep currents, bringing cold water from polar regions to replace the warmer water that is continually flowing as (notably) in the Gulf Stream, from the equatorial towards the polar regions, as well as to make good the immense loss which is constantly taking place by evaporation from the surface of tropical seas." "The examination which Prof. Huxley has been good enough to make of the peculiarly viscid mud brought up in our last dredging at the depth of 650 fathoms, has afforded him a remarkable confirmation of the conclusion he announced at the recent meeting of the British Association, that the Coccoliths and Cocospheres are embedded in a living expanse of protoplasmic substance, to which they bear the same relation as the *spicules* of sponges or of *Radiolaria* do to the soft parts of those animals. Thus it would seem that the whole mass of this mud is penetrated by a living organism of a type even lower, because less definite, than that of sponges and *Rhizopods*; and to this organism Prof. Huxley has given the name of *Bathybius*. This calcareous mud, composed partly of these bodies and partly of living *Globigerina*, has been compared to the great chalk formation, and the reporters thus compare the animals found living in it with the marine fauna of the Cretaceous period:—

"Among Mollusca we have two *Terebratulida*, of which one at least (*Terebratulina caput-serpentis*) may be certainly identified with a Cretaceous species, whilst the second (*Waldheimia cranium*) may be fairly regarded as representing, if not literally descended from, another of the types of that family so abundant in the Chalk. Among Echinoderms we have the little *Rhizocrinus*, that carries us back to the *Apocrinæ* tribe, which flourished in the Oolitic period, and which was until lately supposed to have had its last representative in the *Bourgettierinus* of the Chalk. Among zoophytes, the *Oculina* we met with in a living state seems generically allied to a Cretaceous type (*O. explanata* of Michelin), and the remarkable abundance of sponges, which not improbably derive their nutriment from the protoplasmic substance that enters largely into the composition of the calcareous mud wherein they are embedded, is a pre-eminent conspicuous feature of resemblance. It can scarcely be doubted that a more sys-

tematic examination of the remarkable formation at present in progress would place in a still stronger light the relationship of its fauna to that of the Cretaceous period; since the specimens which our few dredgefuls contained can only be considered as a mere sample of the varied forms of animal life which this part of the ocean bottom sustains,—its ‘*Urschleim*’ being both physically and physiologically the foundation of the whole.”

The authors also refer to deep sea forms found in the Mediterranean :

“That bivalve and gasteropod molluscs, as well as zoophytes, can exist at depths even exceeding that just named, has been clearly proved by the remarkable observation of M. Alphonse Milne-Edwards (which does not seem to receive the attention it merits), that when the submarine telegraph cable between Sardinia and Algiers was taken up some years since for repairs, several living polyparies and molluscs were attached to portions of it which had been submerged to a depth of from 1693 to 1577 fathoms. Of these, some had been previously considered very rare, or had been altogether unknown, whilst others were only known in a fossil state, as belonging to the fauna of the later tertiary of the Mediterranean basin.” — *Scientific Opinion*.

HONEY BEES KILLED BY POLLEN.—In an article in the *NATURALIST* for February on “Honey-bees killed by Silk-weed Pollen,” you say “we have never before heard of an insect actually losing its life from this cause.” In 1860 my attention was called to the same fact; many hives had their stocks seriously reduced from this cause. On a single specimen I counted over one hundred pollen masses attached to the claws and legs. When the claws are thus fettered, the bee cannot climb upon the combs nor collect honey, and is soon expelled from the hive and must die. The unfettered bees tumble them out with little ceremony. As the common silk-weed (milk-weed we call it here) needs insect aid to free its pollen masses, and thus secure the fertilization of the stigma, there are peculiarities in the structure of the flower to secure this result; and for this purpose the pollen masses are attached to a *cleft* gland. When the insect visits the flower to secure its honey, of which there is an abundance, it must step or the gland to reach the nectary, and a hair or claw entering the cleft becomes fast. To free itself the insect must pull out the gland with the pollen attached or remain and die; and the latter is really the fate of many small flies and moths. — J. KIRKPATRICK, *Cleveland, Ohio*.

LINGULA FOUND LIVING IN CALIFORNIA.—Mr. Tryon announced that Dr. W. Newcomb had dredged at Monterey, California, one living specimen of *Lingula albida* Sowb., which is probably the northern limit of the species, and not in accordance with the general rule of distribution. — *Proceedings of the Conchological Section of the Philadelphia Academy of Natural Sciences*.

GEOLOGY.

PREHISTORIC PICTURES OF THE CAVE HORSE IN FRANCE.—Prof. Owen states that outlines of the head of different individuals of the cave horse when alive, neatly cut on the smooth surface of a rib of the same species, have been discovered by the Vicomte de Lastol St. Jal, in 1863, in his cavern at Bruniquel, under circumstances which indisputably showed the work to have been done by one of the tribe of men inhabiting the cavern, and slaying the wild horses of that locality and period for food. — *Scientific Opinion*.

MICROSCOPY.

AMEBOID MOVEMENTS IN EGGS.—Prof. E. Van Beneden, in some very important researches on the development of the eggs of the lower crustacea, states that there is no vitelline membrane in the egg as it lies in the ovary. He proves it, first, by the amœboid movements already known of other eggs, and which he has observed to be particularly active in these instances; secondly, by the very interesting fact, of his own discovery, that the eggs at this stage, like the Infusoria, swallow, so to speak, globules of carmine. The same fact has been recorded with regard to the white blood corpuscles and other young cells.”—*Schwann, in Scientific Opinion.*

THE MOLECULAR ORIGIN OF INFUSORIA.—The doctrine of Heterogeny, or spontaneous generation, seems to be slowly gaining adherents. Prof. R. Owen has declared in favor of it, and Dr. J. H. Bennett, the eminent pathologist of Edinburgh, advocates it in the “Popular Science Review” for January, under the title given above. He states that animals and plants are developed from ova or seeds, or by parthenogenesis, or by heterogenesis, *i. e.*, from molecules which compose the scum or pellicle seen on the surface of an infusion of any vegetable or animal substance. These molecules “constitute the primordial mucous layer of Burdach, and the proligerous pellicle of Pouchet. These molecules enlarge, and may be seen here and there strongly adhering together in twos and fours, so as to form a little chain.” They continue to unite until they form a short staff, or filament—*bacterium*. These bacteria become longer by uniting with others, and have a serpentine movement whereby they are propelled forward in the fluid, forming a *vibrio*. These bodies disintegrate, and thus a second molecular mass is produced. “In this, rounded masses may be seen to form, which strongly refract light not unlike pus corpuscles, or the colorless corpuscles of the blood. These soon begin to move with a jerking motion, dependent upon a vibratile cilium attached to one of their extremities—*Monas lens*. In a day or two other cilia are produced, the corpuscle enlarges, is nucleated, and swims through the fluid evenly. Varied forms may now occur in the molecular mass, dependent on the temperature, season of the year, exposure to sunlight, and nature of the infusion, all having independent movements. They have been denominated *Amœbæ*, *Paramecia*, *Vorticellæ*, *Kolpoda*, *Keronæ*, *Glaucoma*, *Trachelius*,” etc., etc. “At other times it happens that the molecular mass, instead of being transformed into animalcules, gives origin to minute fungi,” such as *Torula*, *Penicillium*, etc. “In all these cases no kind of animalcule, or fungus, is ever seen to originate from preëxisting cells or larger bodies, but always from molecules.”

“That the infusoria originate and are developed in the molecular pellicle which floats on the surface of putrefying or fermenting liquids, has been admitted by all who have carefully watched that pellicle with the

microscope, more especially by Kützing, Pineau, Nicolet, Pouchet, Jolly and Musset. Schaffhausen and Mantegazza." He holds that the germs of these organisms do not exist in the air, nor multiply by self division, nor are they capable of elongating or aggregating, thus forming filaments or larger masses, unless by the union of other molecules like themselves. Having shown, from the observations of Pasteur and others, that the germs cannot preëxist in the air, he holds that they cannot preëxist in the water, as the numerous experiments by Pouchet, Meunier, etc., have shown that all animal and vegetable germs are killed by boiling them; yet nothing is more certain than that long ebullition of various infusions has wholly failed to prevent the formation in them of animal and vegetable growths, the molecules appearing in them after the water cools. He ascribes their origin to phenomena of a chemical nature, the results of the discussions in the French Academy of Sciences for the last eight years, showing "that not the slightest proof is given by the chemists, with M. Pasteur at their head, that fermentation and putrefaction are necessarily dependent on living germs existing in the atmosphere. They rather tend to show that these are phenomena of a chemical nature, as was ably maintained by Liebig. In conclusion, the author holds that the infusoria, animal and vegetable, "originate in oleo-albuminous molecules, which are formed in organic fluids, and which, floating to the surface, form the pellicle or proligerous matter. There, under the influence of varied conditions, such as temperature, light, chemical exchanges, density, pressure, and composition of atmospheric air, and of the fluid, etc., the molecules by their coalescence, produce the lower forms of vegetable and animal life."

CHICAGO MICROSCOPIC CLUB.—We have received the Constitution and By-laws of this new society, and the Proceedings of the meeting held January 26th, when Prof. Freer exhibited human blood cells showing the cell as a bi-concave disc, with a nucleus appearing as a prominence in the centre; most microscopists having denied the existence of a nucleus in the human blood disc.

ANSWERS TO CORRESPONDENTS.

A. J. O., Morristown.—We would be much obliged for specimens of sheep ticks and their eggs and young, with notes on their habits.

J. S., Lancaster, Pa.—Your notes and sketches of bird parasites were of great interest to us. We would be greatly indebted to ornithologists for specimens of bird ticks, lice, mites and other external parasites, with their eggs and young, as well as parasitic worms, such as the tape-worms and the "round worms." They may be collected in vials of whiskey or weak alcohol, and sent by mail in a strong pasteboard box, or roll of tin. Has any one ever found the bed-bug in swallow's nests; they occur thus in Europe.

S. W. C., Otisco, N. Y.—After making your insect case as nearly air-tight as possible, place camphor in a paper with pin holes, or smear the box with creosote, or keep benzine in constant evaporation in the box. Beetles may be soaked in a solution of corrosive sublimate previous to arranging them in the insect-case. Above all, watch carefully for dust made by devouring insects, which falls to the bottom of the case containing them, by which we may detect their presence in the case.

THE DATE PALM.—In answer to a correspondent who enquires whether dates ever grew so low that a man can pick and eat them as he walks under the tree, we answer

that dates are ripened even when the tree is so young that the clusters may easily be reached from the ground, but the sharp bristling leaves would most effectually prevent any one from walking under the tree. In Egypt the heavy clusters hang down from the base of the leaves, and even in mature trees may be picked by a man on horse-back. The fruit ripens separately on the cluster, and the process goes on for some weeks. The date-palm is by no means a shade tree, and not a pleasant tree to walk under, as the dead and persistent leaves hang and project at various angles, and even where these are trimmed away, the stem remains rough and spiny.—WM. T. BRIGHAM.

J. S., New Albany, Ind.—Your specimen is a portion of a growth of some sort of suberose, or corky fungus, such as grows out of the dead or living, but old and hard bark of living trees. It consists, as you will find on macerating a bit of it, of a compact mass of fibres or threads once alive, and which is called 'mycelium;' and this particular kind can be found frequently between the layers of the timber of the solid trunk, and by its presence the wood is finally destroyed. It is known to botanists as *Racodium* *Xylostroma* of Persoon, the first word signifying "like a rag," the second "wooly-bed," or bed in the wood. It has another name given it by Tode, *Xylostroma gignens*, or the "great wooly bed," and may be found in the timber of the oak, beech, etc., both in this country and in Europe. There are also other species of *Racodium*, some of which from resemblance, are called "Mouseskin," and the like names.—J. L. R.

CORRECTIONS.—Mr. Dall desires us to correct his statement in the March NATURALIST that "no snake of the genus *Elaps* is poisonous," as some of the species are poisonous.

Prof. S. D. Cope writes us that the dislocation in the jaw of the ally of mosasaurus (mentioned on page 55) is normal, and not the result of an accident,—our own inferences were incorrect.—EDS.

BOOKS RECEIVED.

Practical Floriculture; A Guide to the Successive Cultivation of Florist's Plants, for the Amateur and Professional Florist. By P. Henderson. Illustrated. New York: Orange Judd & Co. Price \$1.50.

Library of Education. Some thoughts concerning Education. By John Locke. New York: J. W. Schermerhorn & Co. 1869. 32mo, pp. 192. 15 cents.

The Pampas and Andes. A Thousand Miles' Walk across South America. By N. A. Bishop. Boston: Lea & Shepard. 1869. 12mo, pp. 310.

The Record of Zoological Literature, 1857. Vol. IV. Edited by A. C. L. Günther. London, 1868. John Van Voorst. 8vo, pp. 678.

Scientific Opinion (Weekly) for January, 1869. London.

Journal for the Popular Diffusion of Natural Science. Edited by C. Fogh, C. F. Lütken, and Eug. Warming. Series iii. Vol. I, Part 1. Copenhagen, 1869. 8vo.

Archiv für Anthropologie. Vol. II, Part 3. Braunschweig, 1868. 4to.

Cosmos (Weekly). December 19—February 6, 1869. Paris. 8vo.

Canadian Naturalist and Geologist. Second series. Vol. III, Nos. 1-4.

The Field. December 19—February 20. London.

Journal of Travel and Natural History. Vol. I, No. 4. London. 8vo.

Land and Water. November 28—February 6.

Popular Science Review. January, 1869. London.

Quarterly Journal of Science. January, 1869. London.

American Bee Journal. February, March, 1869. Washington, D. C. \$2.00 a year.

Bulletin of the National Association of Wool Manufacturers. Jan., 1869. Boston. 8vo.

Le Naturaliste Canadien, Bulletin des Recherches, Observations et Découvertes se rapportant à l'Histoire Naturelle du Canada. Tom. I, No. 2. Janvier 3, February, 1869. 8vo, pp. 25. \$2.00 a year.

Report of the Commissioners of Fisheries for the year ending January 1, 1869. Boston, 1869. 8vo, pp. 71.

The Canadian Entomologist. February 15. Vol. I, No. 7. Toronto.

The American Entomologist. March, 1869. St. Louis: R. P. Studley & Co. \$1.00 a year.

One Thousand Objects for the Microscope. By M. C. Cooke. With five hundred figures. London, 1869. 12mo. Price \$1.00.

